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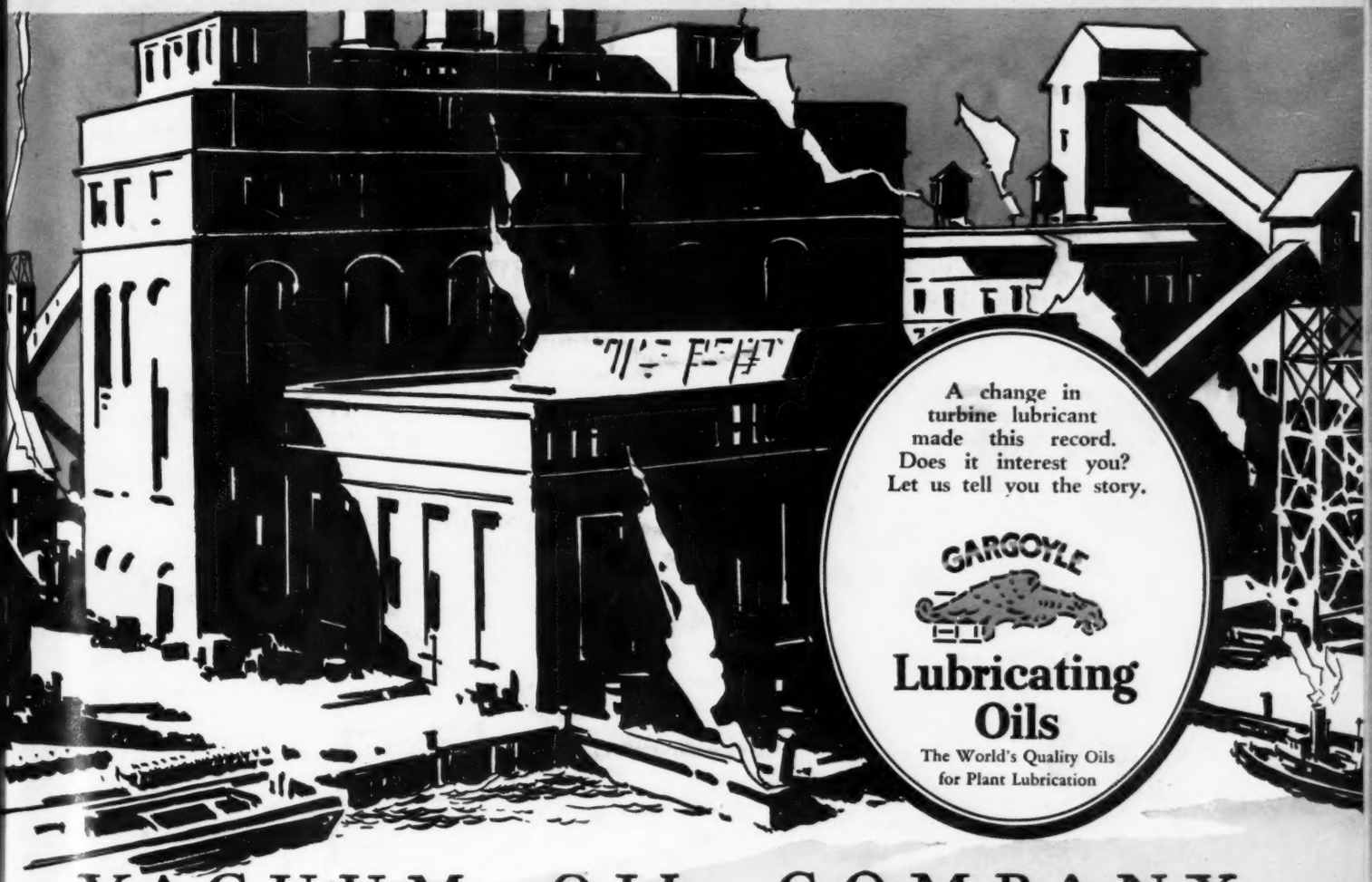
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Electrical World

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Construction and Installation Methods Issue

THIS issue of ELECTRICAL WORLD is devoted to a pictorial presentation of the most modern practice in electrical construction. It embraces a great number of examples of construction methods which have either led to economies of time, labor or materials or assured greater reliability of service. It includes both utility and industrial experience gathered from all sections of the country, under a wide variety of conditions.

For convenience in viewing this panorama of modern construction and installation methods, illustrations and descriptions have been grouped as follows:

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In vast numbers of generating stations and substations, Okonite wire and cables are controlling the operation of the major units of electrical equipment. In their various types, they are used for station wiring, for generator leads, for apparatus control, and for the many connections between switches, transformers, converters, regulators and other station and sub-station equipment.

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In the underground sections of distribution systems is found the general use of Okonite rubber and varnished cambric insulated cables:—for street lighting circuits, primary feeders, secondary mains and customers' services. And now Okonite-Callender impregnated paper cable is being used increasingly for distribution voltages because it is also built upon the Okonite principle that no part of electric plant is unimportant and the best kind of product is needed in every path leading from the station to the customer. In overhead distribution and other installations there is the same popular employment of Okonite Tree Wire, Okonite Parkway Cable, Okonite Twisted Service Cable and the high quality brands of insulating tapes—Okonite Rubber and Manson, Dundee "A" and Dundee "B" friction tapes.

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The Hurricane and the Lineman

THE recent tropical hurricane played havoc in the West Indies and in a large section of the Southern States. Not only was there a lamentable loss of life, but property damage ran into many millions of dollars. Coming on top of previous losses from storms from which the Southeastern section had just about recovered, the blow was greater than has been generally realized. In no storm of recent years has the destruction of trees been so great. Throughout South Carolina and Georgia many huge trees planted just after the Civil War were uprooted and blown across electric power lines, adding darkness to distress. But if the streets were blocked by fallen trees, they were not deserted. All during the night of the storm linemen were at work cutting away trunks and branches of trees in an almost superhuman effort to restore service; so that by morning or before nightfall few of the many towns and cities affected were without electricity.

In Florida the destruction of homes was as widespread as that of trees elsewhere, and the toll of human life was likewise greater. Under the lash of one of the most destructive hurricanes on record, when great anxiety prevailed throughout the nation, the linemen of the electric light and power industry proved heroes. There was nothing spectacular about their work—they toiled on in the darkness, with none to applaud; but that there were few fatalities from fallen wires and that service was so quickly restored throughout the stricken area speaks volumes for the work of these men. The industry is justly proud of them. Material losses dwindle into insignificance when compared with the misery wrought by widespread death and injury of human beings in such disasters. With Nature's bursts of fury men have not yet learned fully how to cope. But men can prevent additional destruction caused by their own instrumentalities, and, thanks to its army of courageous linemen, the electrical industry in every catastrophe from storm or flood does this.

* * * *

Water-Power Development and Politics

WHILE apparently it was inevitable, it is none the less disconcerting and discouraging to have the question of water-power development in this country again made the football of politicians. At best the increasing efficiency and economy of steam-power plants has rendered the prospect of great water-power development problematic, and now, to put a quietus on the whole situation, the politicians are trying to make a national issue of it. What is and always should be an economic and engineering question is thus endowed with a prominence it scarcely deserves.

Commercially speaking, water power has been remunerative in so moderate and uncertain a degree that the fingers of one's hand will suffice to count all the responsible manufacturers of waterwheels in this country. Obviously there must be something wrong, for if the business is what the politicians claim it is, there should be very many more waterwheel manufacturers. Again, one of the most constructive pieces of national legislation enacted in recent years was the federal water-power act. Its value is proved by many developments which have taken place under its provisions, and yet memory is so elusive and fickle that many forget that there is such a law, that it represents a national water-power policy and that it was enacted by a Democratic administration. And why contend for government ownership of water powers when fully 80 per cent of all those undeveloped in this country are already government-owned, and when most of the water powers now harnessed are under public regulation?

Water-power development, notwithstanding the vain imaginings of the politicians, is an economic and a regional question rather than a political and national one and can best be solved along economic and regional lines. To saddle it with any other load will stunt its legitimate and proper growth to the detriment of the entire nation, and even a superficial study will reveal that the question of water-power conservation is too intricate and its outcome too uncertain to be intrusted to inexperienced and incompetent hands.

* * * *

Trade Commission Resumes Its Trial by Newspapers

HEARINGS by the Federal Trade Commission in the investigation of the publicity activities of utility companies were resumed last week after the summer season. Again there was immediately demonstrated the futility and unfairness of such a trial by implication, where a great industry is damned before the country through an inquisition in which only one side is heard. The incident was illuminating.

During the adjournment representatives of the commission examined the vouchers covering several years' expenditures by the National Electric Light Association. These were voluntarily made available. Out of thousands 104 check vouchers were selected. For each of these a complete history of the transaction was provided and pasted to the check. The checks were turned over to the commission and were introduced into the hearing and then placed upon the press table for inspection. Now witness the workings of such a trial by newspapers.

Next morning column articles upon the hearings appeared. One of the most prominent conservative metropolitan dailies said: "By an aggressive, adroit examination the chief counsel brought out that money had been paid to these persons"— It listed William Allen White, Bruce Barton, Lord, Thomas & Logan, the Smithsonian Institution and other names, the inference being that the money was spent to influence writers and public men. Written plainly on the paster, however, were the facts that White was paid his bill for addressing the convention, that Barton was paid his bill for material for an advertising campaign, that Lord, Thomas & Logan were paid for signed advertising placed in publications, that the Smithsonian check covered a purchase of institution bulletins and so on. Each case was a transaction in the regular business of the association and the facts were all there. But the young men at the press table were eager not for truth but for a story. They built their stories with such morsels as they could pick out of the material provided.

The public, of course, wants just the facts—the truth. It expects the commission to find these facts. It relies on the newspapers to publish the truth as it develops. But the commission devotes itself to asking questions that imply wrongdoing and has so far not permitted the power industry to present its case. And the press, when the "exhibits" are tossed to the reporters to scramble over, ignores the plain truth and dishes up artfully induced sensation. Is this the kind of investigation the Senate desired? And is it aiding the public to understand and form a sound judgment about the public utility companies?

* * * *

Economy Through Ample Construction Equipment

LABOR is expensive. It constitutes a large proportion of the expense of installing electrical equipment, whether it be for generation, transmission or utilization. When the ratio of labor cost to total erection cost goes too high, this can very often be traced to an unbalanced utilization of mechanical equipment and manual labor. For example, in transmission or distribution construction, trucks, derricks, digging, trenching machines and other labor-saving devices are too few in number and are overworked while construction crews kill time waiting for material to arrive or until some needed piece of equipment is moved up.

Greater economy in construction work can be effected through an apparent surplus than through a deficiency in labor-saving equipment. It is far cheaper to pay the fixed charges on a truck when it and its driver are idle for an hour or so than to pay the hourly rate for a crew of men to wait for a belated truck to bring up a load of poles or a tractor to pull in the line wire. The same general principle holds true with other mechanical equipment used on construction work. Labor-saving devices must be available when needed, and, remarkable as is the performance of some of these machines, they cannot think for themselves or for the construction superintendent. Their real economy lies in being on the job when and where they can be used. Good administration of construction programs shows that it is far cheaper to provide ample transportation and mechanical equipment than it is to force crews to kill time. Otherwise labor savers may be that in name only.

Linking Far-Flung Areas for Better Service

INTERCONNECTION'S successes are not all associated with heavy high-voltage line construction. There is a large field of usefulness for less ambitious engineering in facilitating energy interchange between such communities as, for example, are being tied together in New Hampshire. Even the casual visitor to the White Mountain region and south-central lake area sees a good deal of moderate-voltage line and substation construction under way as a result of the recent acquisition of control of many scattered properties by a single interest. The imagination of the engineer is quickened by an understanding of what this means to many communities either dependent upon small local plants isolated from their fellows or deprived entirely of service because it could not be satisfactorily financed without holding-company credit, barring the undesirable alternative policy of loading the burden upon the taxpayer and perhaps asking him to "ho'd the bag" for municipal operation.

An impressive point about this sort of development is the value of many existing lines, rights-of-way and substations in the betterment scheme. Most engineers would hardly cast a second glance at many of these lines in passing through the region by motor car or rail, and yet their economic value is substantial. The loads are often relatively small in individual communities, but the advantages of tying together hydro-electric plants on different streams and even on the same stream are obvious. This can often be done without embarking on a comprehensive scheme of trunk transmission construction. Useful links can be built and much of the old equipment salvaged for better service until the day arrives when increasing demands warrant larger facilities. The new work serves as a nucleus of a future system planned to meet the load and interchange requirements of another day, and if properly articulated to these, later prospective developments can be made to serve as a high-voltage distributing system when the time comes to run heavy transmission trunks through the territory.

* * * *

New Ideas in Home Lighting

FRENCHMEN are leading the way in a new conception of home lighting. At the convention of the Illuminating Engineering Society in Toronto last week paramount interest centered on the idea that lighting and architectural design should be concurrent—that lighting installations are a part of building construction. In other words, built-in low-intensity light sources, often colored, become part of the architectural design of a room. The new trend does not depend on fixtures, upon wall brackets or upon home, hotel or auditorium owners' taste in decorative lighting ware. It places lighting on a professional architectural plane.

With America pre-eminent in many electrical developments, it is astonishing that a French movement of 1925 only now receives credit in this country. Its ideas are sound. Problems of an economic, technical and educational character must be solved before the principles become established, but this is no cause for discouragement. The new idea focuses attention on a way to eliminate the abominable lighting that predominates in American homes and assembly halls. This is half the battle.

Provincial Engineering

MECHANICALLY minded citizens have long regarded with amused tolerance the traditional tendency of the farmer to purchase a piece of high-grade machinery and then, when the season for its use is over, to leave it exposed to the elements, collecting rust and rapidly disintegrating rather than wearing out in useful service. That better treatment is accorded to cattle and other livestock may be due to an instinctive distrust felt by agriculturists for the products of engineers.

The jest is not always at the expense of the provincial citizen, however. The finely machined and carefully built equipment ordered for installation in a new generating station too often lies out of doors for weeks or even months with the wholly inadequate protection of smeared grease, tarpaulins or oiled paper. The cost of this unconscionable lack of intelligent planning may be relieved by the use of the depreciated material, but eventually the charge against incompetence must be paid.

The remedy is simple, though not necessarily easy of accomplishment. Proper foresight will minimize the period between delivery and installation. Granted that erection schedules cannot be delayed pending the arrival of essential parts, delivery plans may be adjusted to meet carefully anticipated material requirements. It is the inflexibility of the customary planning that militates against satisfactory results. Where a margin of one month may constitute a factor of safety, a margin of three or four is an indictment. The tendency to disregard this condition or to make half-hearted efforts to meet it is a reflection upon the organizing ability and construction knowledge of many otherwise capable engineers. It is the more surprising since the condition is so nearly universal.

* * * *

"Rubber-Stamp" Management Cannot Prevail

PROGRESSIVE men have always been essential to electrical development. With rare exceptions, industry leadership has constantly realized the value of initiative and ability and will continue so to do. Nothing in the present trend toward centralized control of local light and power properties should warrant misgivings on the part of competent operating, engineering and sales executives when such men peer into the future. Perfect justice is too much to expect in human institutions, but the "batting average" is high.

Occasionally anxiety regarding the relation of a local executive with the leading personnel of a new headquarters organization reaches the editorial ear or eye, and this prompts one or two comments. Given a willingness wholeheartedly to adapt one's self to the new régime and the staying power to follow through no matter how strange or irksome new methods and regulations may prove to be, worry should cease. Refusal to co-operate with headquarters to the limit of local ability and power sometimes occurs out of fear that nothing but "rubber-stamp" management will be acceptable. The industry is moving ahead too fast to warrant any such policy. On the other hand, amiable acquiescence can easily become supine weakness. Every enduring administration of a group of properties from a central headquarters must encourage initiative locally, with good-tempered discussion of ideas, the ability to lose gracefully and to win without egocentricity.

There is no more chance of rubber-stamp management succeeding in the long run in the electrical industry than there is of a secondary school qualifying its graduates for the doctorate. Let the doubters take heart and gird their loins for new achievements!

* * * *

Interdependence of Electrical and Process Industries

NO BETTER indication of the interdependence of the electrical and all other industries can be found than in the convention of the American Electrochemical Society held at Charleston, W. Va., last week. Here a body of scientific men met in a locality which in very recent years has become conspicuous for its development of process industries. The electrochemists went there to discuss technical problems and to inspect and study practical applications of electrochemistry, electrometallurgy and electrothermics. Inspection trips to fifteen or more industrial process plants more than justified the choice of Charleston as a meeting place.

But even more important to the electrical industry is the extent to which these industries rely upon electricity for the successful operation of their processes. Not only in electrolytic and other electrical processes do these plants utilize electrical energy, but they are large consumers of power for motor and industrial heating applications. For the most part the plants find it more economical to buy power from the central-station company, generating only that part which is incidental to the need for steam for heating processes. These industries already afford a large market for electrical equipment and electric power, but many of their problems still remain to be solved. The power industry and manufacturers of electrical apparatus might find it extremely profitable to familiarize themselves by closer study with the needs of the electrochemical and related industries.

* * * *

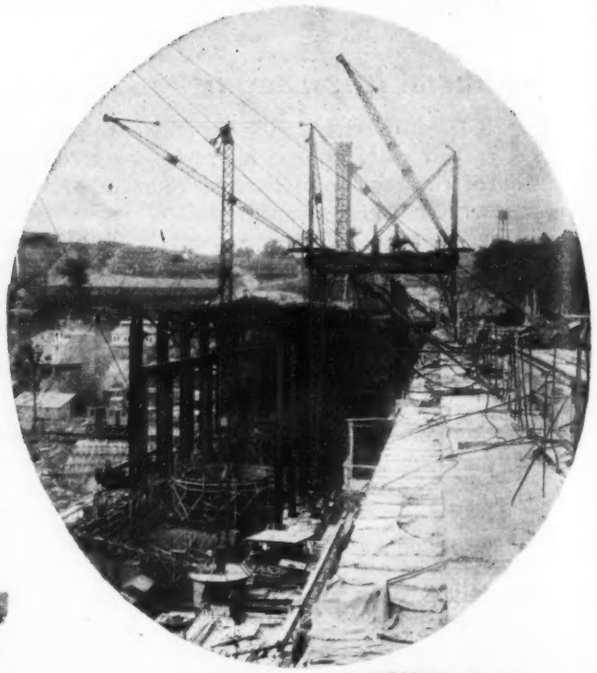
Why Not Capitalize on Construction Experience?

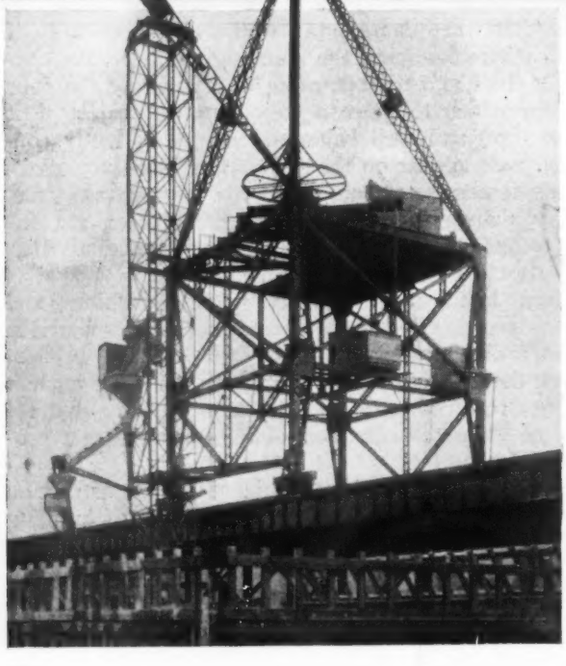
CONSTRUCTION men should have a prominent place in the planning as well as the building of projects. The financier, the planning engineer, the construction chief and the operating executive are the four legs upon which to place a contemplated project if it is to be level and well balanced. Too frequently construction men appear on the scene after plans are made, financing is completed, purchases are consummated and materials delivered. The construction forces are the action troops on projects, and the experience of their leaders should be utilized in staff councils.

Modern builders use dollars, labor, machines and power as tools. The brute force, the crude materials, the unrecorded knowledge and the lack of plan that characterized the building of the Pyramids and other ancient works are replaced with a complex mechanism that requires the close co-ordination of all factors to get economical results.

Nothing can replace the experience of a construction crew that has served its time under all kinds of building conditions. Through intimate contact with actual work these men get theoretical and practical experience of great economic value. Their experience and talents should focus in the top group of those who plan.

Material Handling at Conowingo





CONSTRUCTION work on the Conowingo dam and power house of the Philadelphia Electric Company was aided by the use of several unusual material-handling methods.

In the erection of the structural steel for the power house and for the arbor steel of the outdoor switching station located on the roof of the power house, a temporary, specially constructed traveling derrick was used. This was of long-and-short leg construction, one set of wheels running upon one of the permanent gate gantry rails and the other set using a temporary rail placed on the turbine room roof steelwork.

A construction bridge and gantry travelers were used in the work on the dam. These travelers were designed to operate on the outside rails of the bridge and provided sufficient clearance for standard-gage railroad cars operating on the three tracks on the bridge.

Each gantry was mounted on a 15-ton stiff-legged derrick with a steel concrete-hoist tower. Loading was made from the railroad cars bringing concrete from the mixer. The placing of forms was facilitated by the gantry-mounted derrick.

Proven Economy in Construction and Installation

CONSTRUCTION and installation methods which bring about economies in time, money, labor or operation without sacrifice of service reliability or impairment of investment are vital to both utility and industrial men. All business today is struggling to pry a little farther apart the upper and nether millstones of lower competitive selling prices and production costs. Mass production, mergers and consolidations have played an important part in the national trend toward economy. Still, over-all economy cannot be effected unless it is practiced both in the building of an industry and in the detailed methods which it employs for maintenance and growth.

Commendable progress in engineering and economic efficiency is recorded each year in the electrical industry, for electricity fits into the industrial and social requirements of modern civilization and the interdependence of the electrical industry and other businesses becomes more apparent and more binding. Those concerned with electrical development seek therefore constantly to improve in technical and in economic efficiency, and there is evidence of positive and impressive progress.

ECONOMY has become to many a basic measure of engineering perfection. Moreover, one of the prime requirements of the successful executive must be his ability to invest increasingly larger amounts of money in the business and at the same time continue to earn a satisfactory profit upon the additional capital. There can be no extravagant expenditures for extensions or additions which are not justified by careful estimates of future growth. On the other hand, new additions to a plant or system cannot be made in niggardly fashion. Cheapness is always dear at any price.

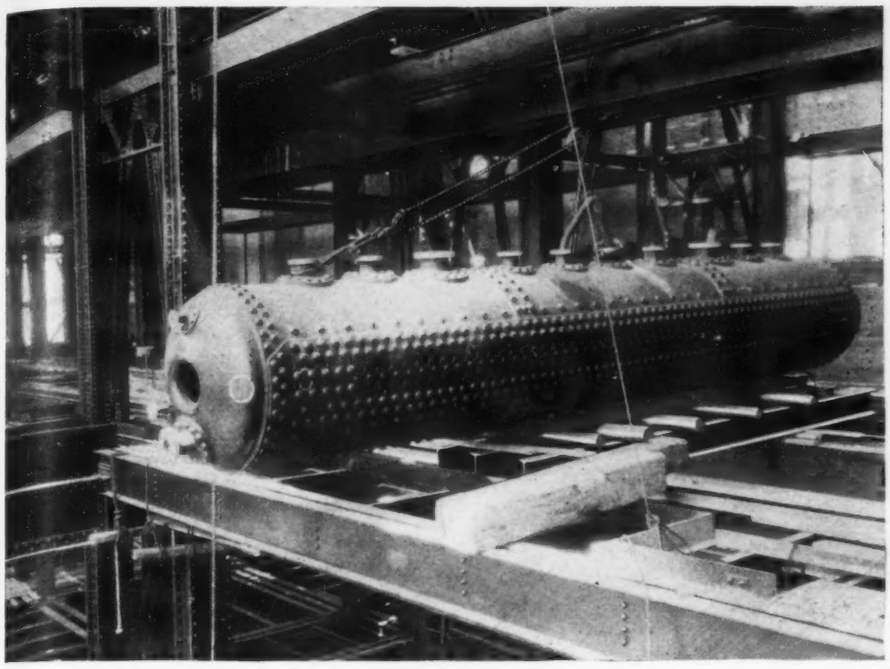
Engineering is a broad term. It involves many little things as well as major problems. In the power station, the interconnected system, the industrial plant, and in electrical manufacturing are involved design, construction, installation and operation, and each of these things must be measured in economic values. The engineer must make an economic use of men, time, money and materials. No engineering job is complete or successful unless it yields these values that may be measured in units common to all worthy projects. Advance is materially measured in things accomplished; but the engineer should also scrutinize the details of the technique that is continuously evolving to make progress possible.

THIS issue of the ELECTRICAL WORLD is devoted to picturing economies in construction and installation—methods, policies and practices of proven value in actual use. Savings in dollars effected at the expense of quality of construction or operating conditions are not true economies and no implied indorsement of such methods will be found here. Both the executive and the engineer who bear in mind the permanence and stability of their property operating at maximum economy will, we feel confident, find these data from the experience of others worth study and possible application.

Phase Segregation at Low Cost

INCREASED segregation of phases has been obtained at the South Meadow generating plant of the Hartford Electric Light Company by the type of cell design illustrated, and without going to the expense of complete isolated phase switch house construction. Standard concrete cell construction is employed as regards dimensions and non-continuous reinforcement, the special feature of the design being the erection of cells with alternating openings and end slabs, with flush doors. A row of cells for a group of 11-kv. oil circuit breakers before the installation of apparatus, the completed structure with cell doors in place and a close-up of a 3,000-amp. breaker and sub-cell disconnecting switches controlling service from the new mercury vapor generating unit now being installed at this plant are shown in the accompanying illustrations. The cell arrangement shown, which provides monolithic arc-isolating barriers between phases, was suggested by T. H. Soren, vice-president of the Hartford company.

Top—Phase segregation by staggered cell openings. In center—Completed cell group with flush doors. Bottom —Close-up of 3,000-amp. breaker cell



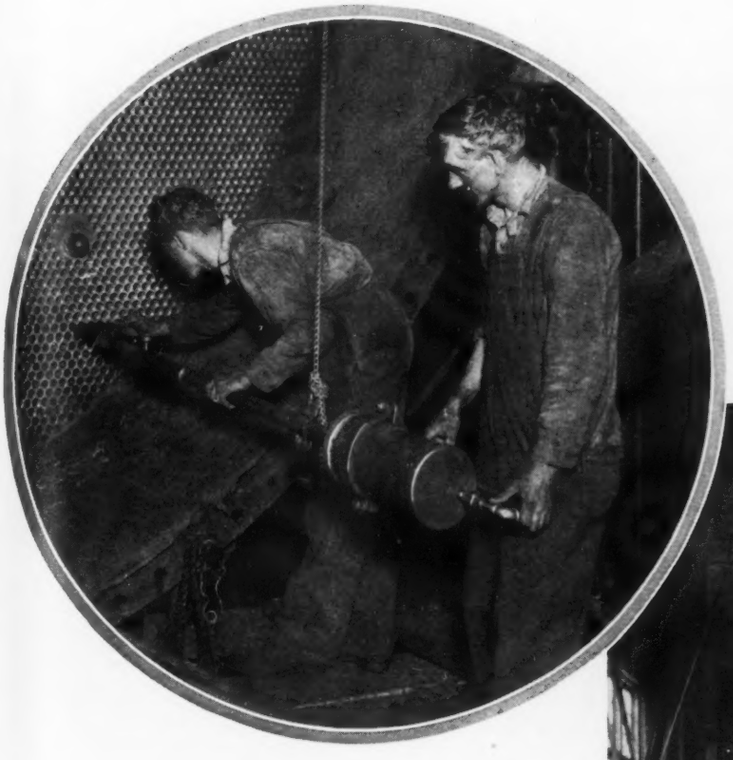
Getting Steam Drum Into Position

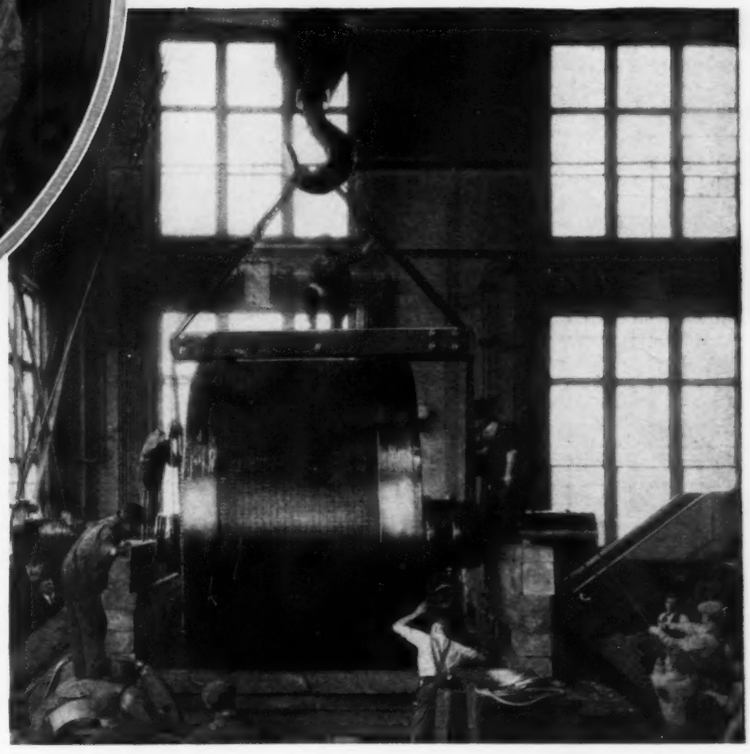
THIS steam drum for the New York Edison's East River station has been hoisted through the opening which the boiler will occupy and has been skidded to the right on rollers by means of a chain block. Four I-beams served as the runway for the rollers. The steam drum is being held in this position until other equipment has been hoisted and the areaway released for boiler construction.

Extracting Condenser Tubes

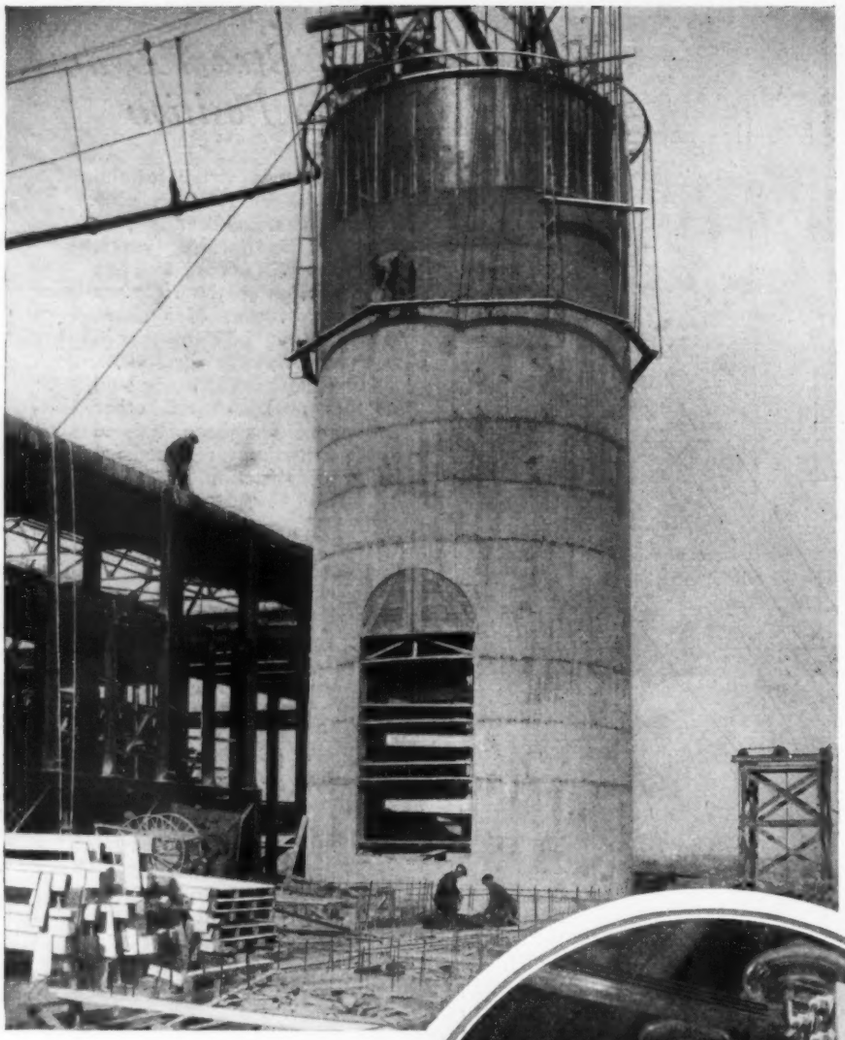
A TUBE puller is used by the United Electric Light & Power Company to grab the tube and packing. The second operation involves admission of air to the power piston which pulls the tube and packing out about 8 in. The lever which operated the mechanism for grabbing the tube and packing is then released and the tube is pulled out by hand.

It takes about six seconds to pull a tube out as compared with one minute when the old method was used. It is possible now to retube a 10,000-tube condenser in a week's time.





HANDLING A 113-TON ROTOR. — While handling this rotor with a crane, the end windings were protected by a spacer between the slings from the crane hook. The spacer is built up of several layers of plank bolted together at the ends and middle to prevent buckling. A metal saddle on each end of the spacer prevents the cables composing the sling from slipping off.

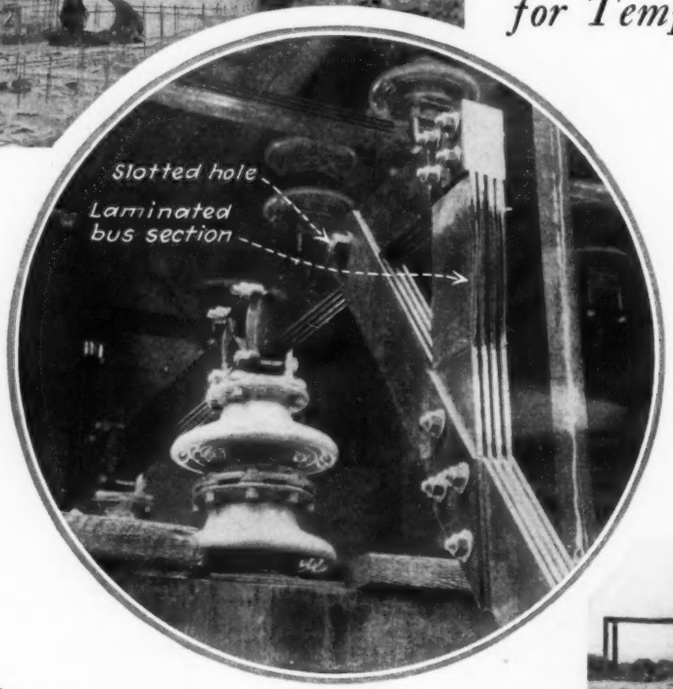


Stack Erected at Rate of 7.5 Feet per Day

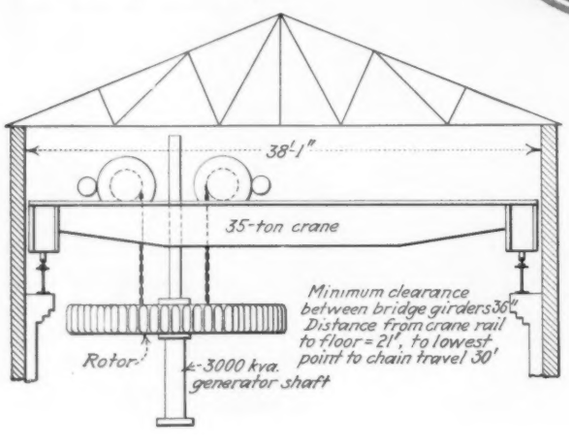
SIX men, including a construction foreman and hoisting engineer, erected the Heine reinforced concrete stack shown at a rate of one section, or 7.5 feet per day, at the Somerset station of the Montaup Electric Company. Concrete was hoisted from the ground through the interior of the stack and poured from the top into steel forms set in exact position by a patented portable diaphragm equipped with adjusting bolts and centered by a plumb line over a target at the top of the chimney foundation. The form sheets were so constructed that a uniform taper was obtained from bottom to top of the stack. The outside form sheet overlapped the section slightly and the inside form sheets were used in two units per section to enable half the section height to be poured and tamped at a time.

Compensates for Temperature Changes

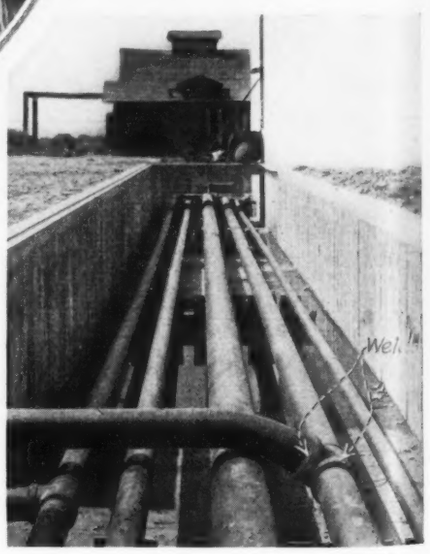
REDUCTION of stresses due to temperature changes in the bus between the 30,000-kva. transformers and the 11-kv. bus at the Big Creek No. 2A hydro-electric plant of the Southern California Edison Company was effected by installing a laminated section as shown in the accompanying illustration. A slotted hole permits the oblique bus section to change in vertical position with respect to the horizontal section. The laminated section permits freedom of movement.



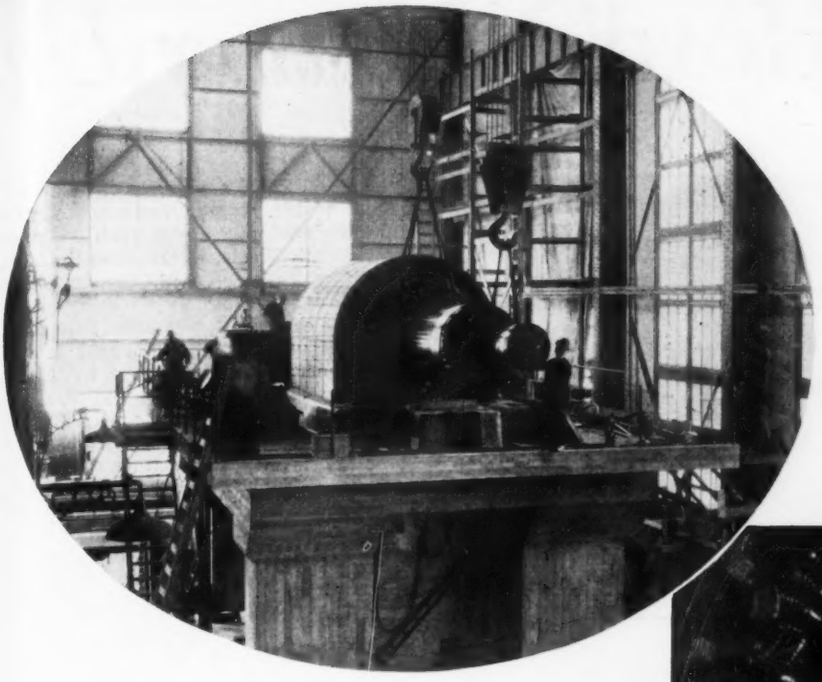
DOUBLE HOIST CUTS HEADROOM. — Frank H. Mason, chief engineer New England Public Service Company, reports that a reduction of 8 to 10 ft. in operating room height was obtained in one of the Central Maine Power Company's hydro stations by providing a double hoist on a single crane bridge. By its use pieces of apparatus can be turned over, which is an aid to erection work. The saving in building construction exceeded the additional cost of a double hoist on the 35-ton crane by about $15,000.


38'-1"
35-ton crane
Minimum clearance between bridge girders 36"
Distance from crane rail to floor = 21', to lowest point to chain travel 30'
Rotor
3000 kva. generator shaft

WELDED PIPE FITTINGS PREVENT OIL LEAKS.—To prevent leaks in the extensive piping system for transformer and oil circuit breaker oil at the Long Beach No. 3 steam plant of the Southern California Edison Company, all tees, couplings and valves have been either welded or brazed, depending upon the material in the pipe.



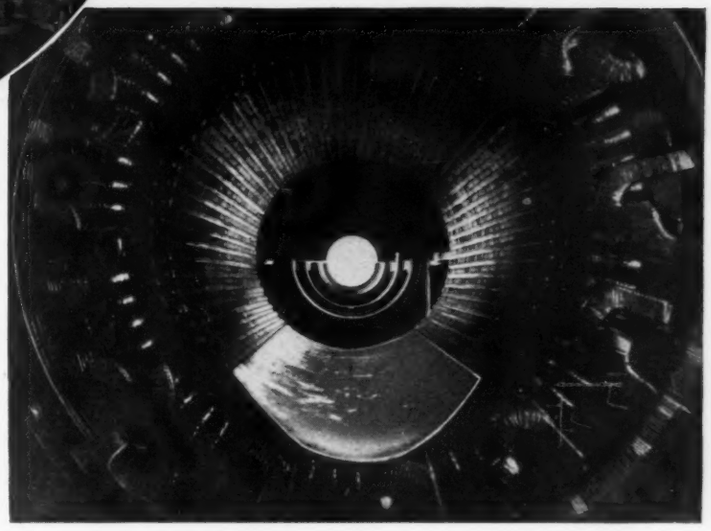
Protecting Windings While Installing Rotor



Rotor supported by crane while being slid into place on metal shoe in lower part of stator

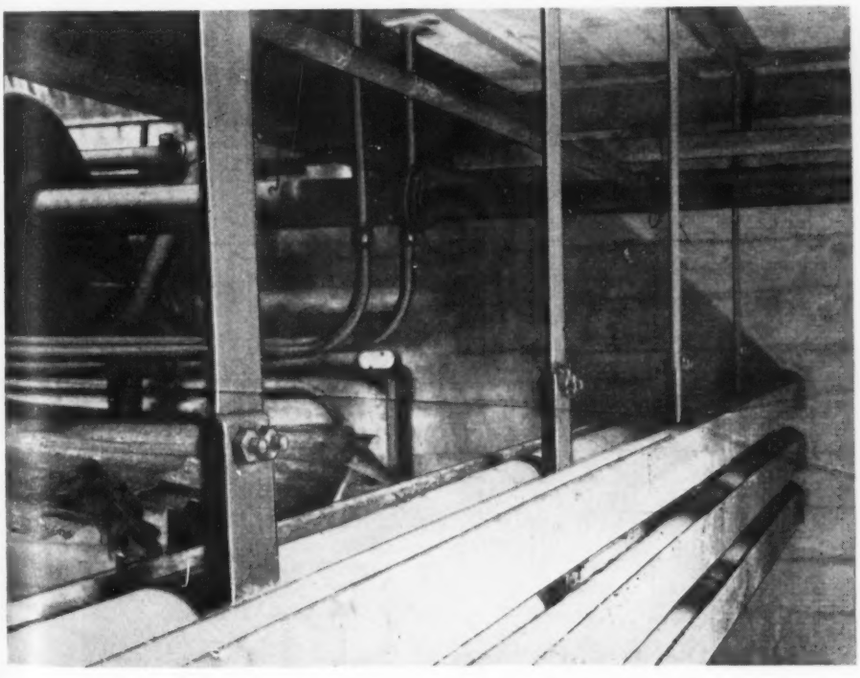
TO GUARD against the possibility of damaging the laminations and windings when installing the rotor of a 37,500-kva. generator at the station C steam plant of the Pacific Gas & Electric Company at Oakland, erectors for the General Electric Company used a thin metal shoe placed in the bottom of the stator upon which to slide the rotor. The rotor was supported by slings from the crane blocks as it was being slid into the stator. After the rotor was in place on its bearings the shoe was removed.

Owing to the small clearances involved and the size and weight of the rotor this method of installing it proved a time saver and eliminated the possibility of damage to laminations and windings during assembly of the machine.



Metal shoe in lower part of generator stator protects laminations and windings during installation of rotor

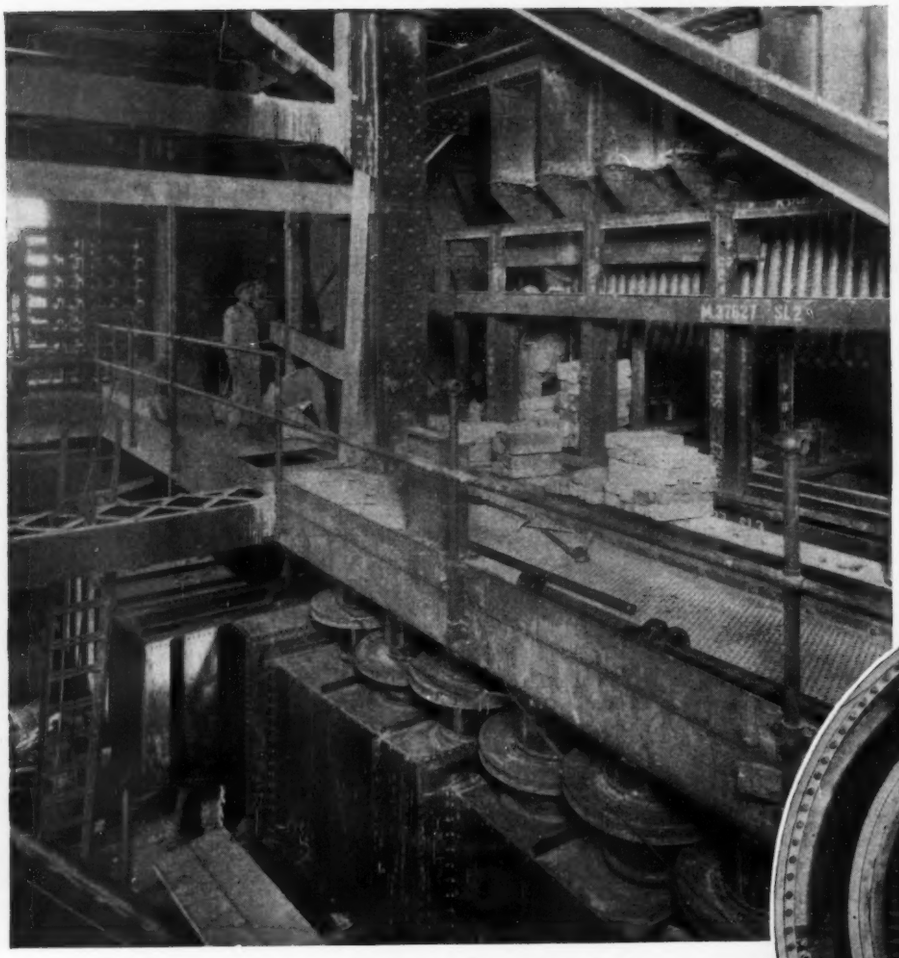
Rigid Protective Supports for Generator Cables



CONSIDERATION of several methods of supporting the three 11,000-volt main leads from a 37,500-kva. turbo-generator at the new station C steam plant of the Pacific Gas & Electric Company at Oakland led to adoption of the type of construction shown at the left. Each phase has two 2,000,000-circ.mil cables which are laid in a trough made up of two pieces of angle iron. The three troughs thus formed are supported one above the other by strap iron hangers secured to the basement ceiling, forming a rigid support for the six heavy cables and at the same time affording adequate isolation of phases. Each cable is fireproofed by a wrapping of asbestos tape. Since the metal troughs do not form a closed magnetic circuit no difficulty is expected from heating.

Hartford's *Mercury Unit*

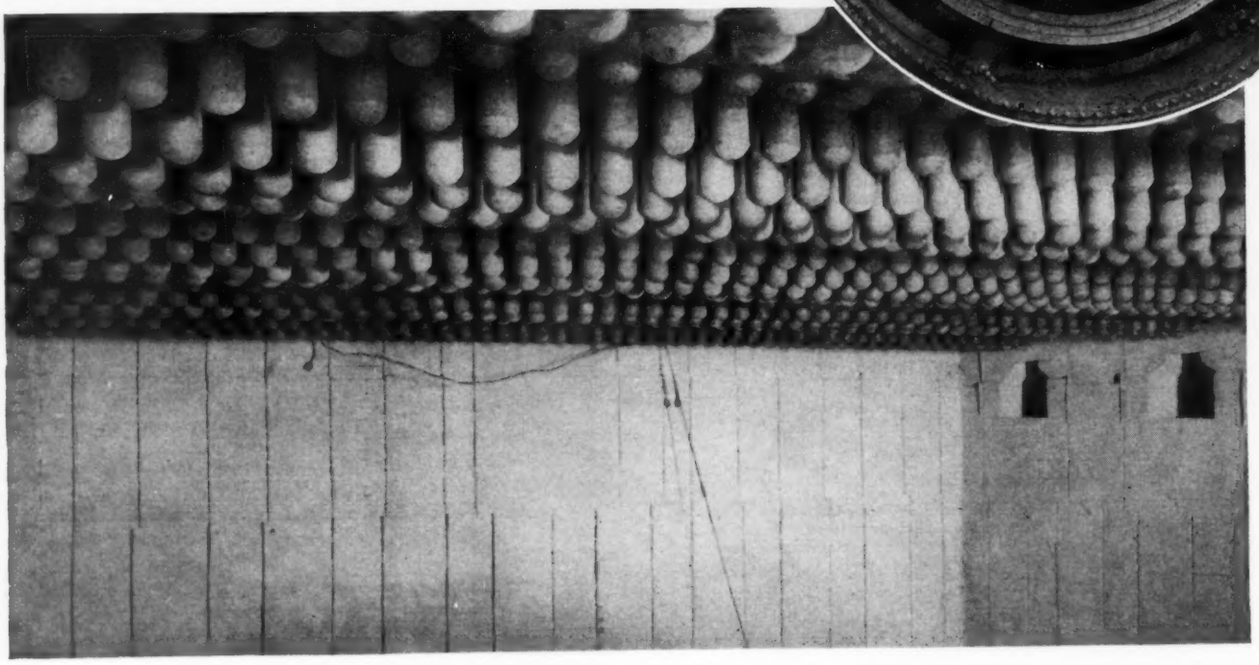
VIEWS are shown of the 20,000-kw. pioneer mercury boiler and turbine unit under erection at the South Meadow station of the Hartford Electric Light Company, which is expected to be on the line during the early fall. About half the above output is to be obtained from a generator direct-driven by a five-stage mercury turbine and half from steam generated in mercury condensers electrically welded to the turbine unit. The decision to install this unit marked a turning point in prime mover history. The



End view of boiler showing lower portion of tubes and upper air ducts

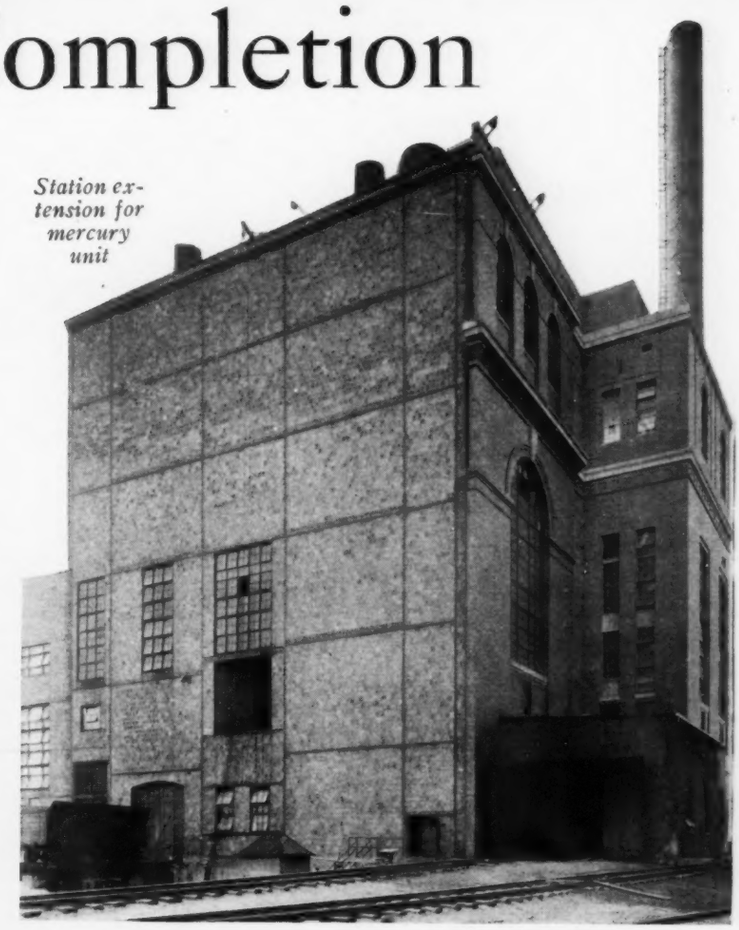
Fourth wheel diaphragm exhaust; mercury vapor condensers at rear on each side for steam generation

Close-up of mercury boiler tubes from below

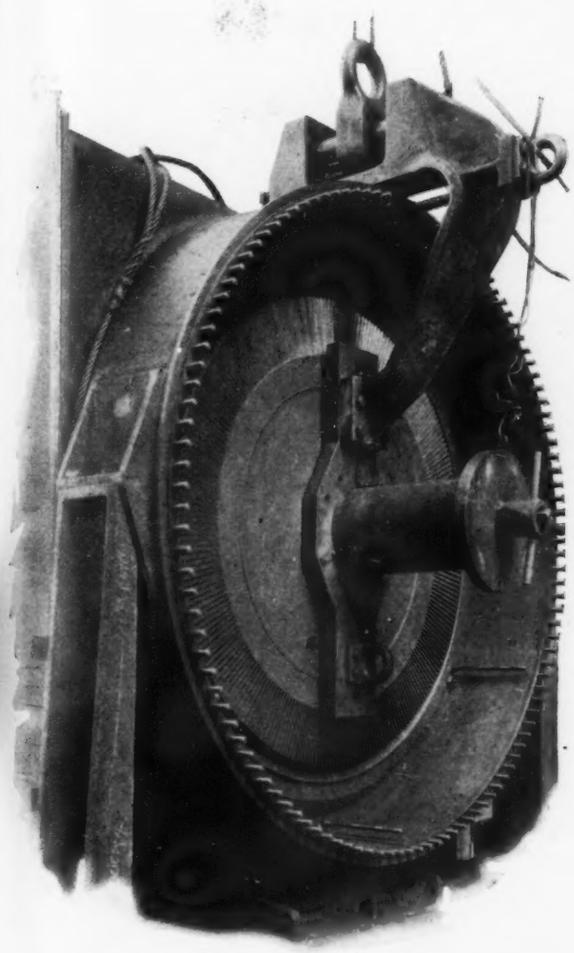


it Approaches Completion

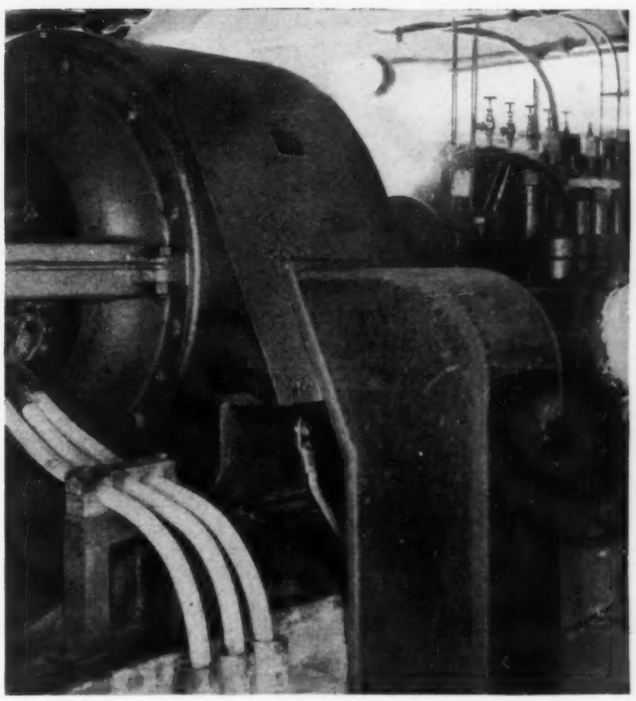
General Electric Company built the turbine and the Babcock & Wilcox Company the boiler from the designs of W. L. R. Emmet of the former organization. The construction work at the plant was done by the Stone & Webster Engineering Corporation.



Station extension for mercury unit



PROTECTION FOR THE 2,300-VOLT LEADS to condenser pumps is provided at the Pacific Gas & Electric Company's station C steam plant in Oakland by the removable sheet-steel housings shown. The three-conductor, lead-covered cable terminates just above the floor in a pothead from which taped wires are carried to the motor terminals. The metal housing is easily removed for inspection.



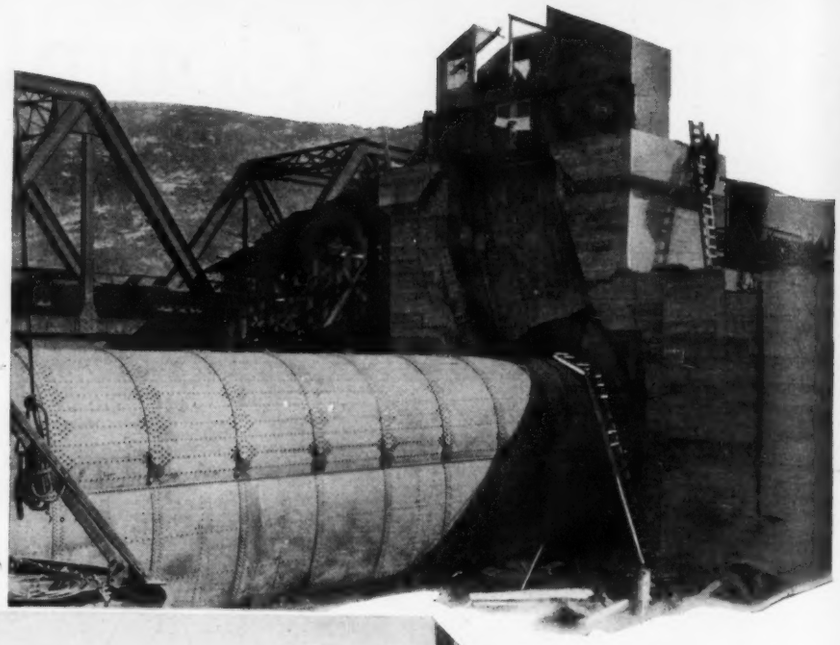
Adjustable Lifting Device Aids Turbine Erection

IN ERECTING the 10,000-kw. mercury turbine for the Hartford Electric Light Company's South Meadow station a special cast-steel hanger was designed by the General Electric Company for use in shop and field. As the turbine barrel which is welded to the condenser unit is not split horizontally in this design, it was necessary to provide a hanger with an offset arm in order to maintain the wheel and diaphragm in balance and in a vertical plane when installing each stage and shrinking upon the turbine shaft. An adjustable eye aids accurate setting.

Roller-Gate Construction Aids Flexible Operation

FLOOD control at the Bellows Falls (Vt.) hydro-electric plant of the New England Power Company has been greatly facilitated by the installation of two "M.A.N." roller gates furnished by the S. Morgan Smith Company and shown in the accompanying illustrations. Each gate (only one shown) consists essentially of a horizontal steel cylinder 121 ft. long x 13 ft. in diameter, having a bottom extension of 5 ft. The total height is 18 ft. and the clear opening is 118 ft. long. The fixed crest in the two bays of the dam is 5 ft. lower than the balance of the spillway. The two gates are raised by 165-ton hoists operated by 22.5-hp. high-torque motors, about 45 minutes being required for attaining full opening.

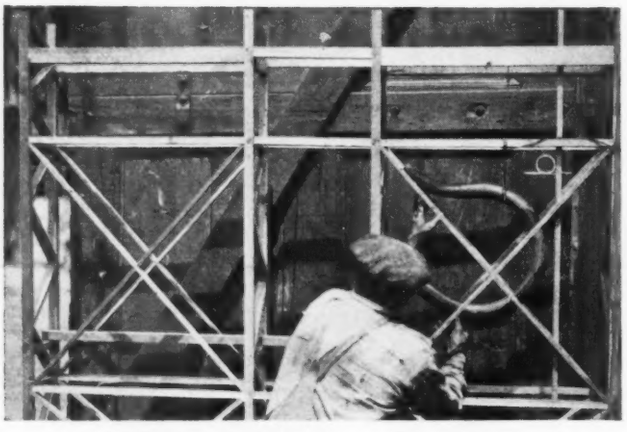
The two bays equipped with these gates can handle 60,000 cu.ft. of water per second, or double the average annual spring flood without spilling water over the flashboards. This contributes to large savings in power utilized from the river, as the gates can be held in any desired opening stage at will. The plant was built by the Power Construction Company of Worcester, Mass.



Roller gate closed

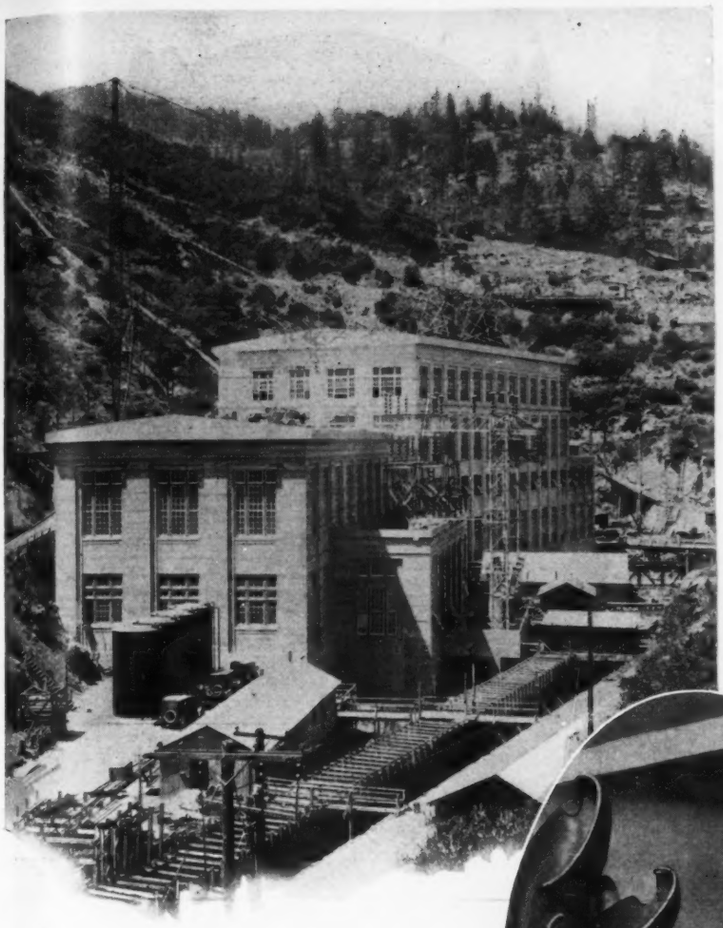
Roller gate open

Model Saves Time in Erecting Steam Pipe



CONFRONTED with the problem of getting a large curved steam pipe into place in its new boiler plant at station C, Oakland, the Pacific Gas & Electric Company greatly simplified the task and expedited the work by construction of a small model of the steel structure in which the pipe was to be placed and with a piece of 1½-in. pipe of similar shape figured out the exact procedure to be followed in placing the actual pipe. The accompanying illustration shows the model and the erection foreman figuring out the location of the rigging and the method to be followed in passing the pipe through the structure.

Experiments with the model proved that it was a complicated matter to get the pipe into final position. Had the small model not been used many days might have been lost on the actual job.



Outdoor Equipment Reduces Building Costs

AN INTERESTING comparison between two generating plants, one built in 1911-12 with all high-tension equipment indoors and the other built in 1928 with outdoor equipment, may be made from the accompanying illustration, which shows the Big Creek No. 2 and 2A plants of the Southern California Edison Company. The older plant, seen in the background, has a height of 100 ft. from floor to roof, while the newer plant in the foreground is only 61 ft. in height. The difference represents the additional height which was required in the old plant to house transformers, high-tension bus and oil circuit breakers. The contrast is even more striking when it is considered that the old plant contains four 17,500-kva. units, as compared with two 45,000-kva. units in the new plant, which by reason of their size require greater headroom.

Safe All-Weather Staging

MODERN power plant construction requires rapid and accurate erection work. Power hoists and staging enable buildings to be fabricated regardless of weather conditions and with particular regard to safety for construction forces and others on the premises. The accompanying illustration of the switch house extension of the Edgar station of the Edison Electric Illuminating Company of Boston, shows the progress made on this job in 21 days. The provision made here for the extension of the power hoisting service and coverage and side protection of the staging contribute to rapid movement of men and materials regardless of the heights involved.

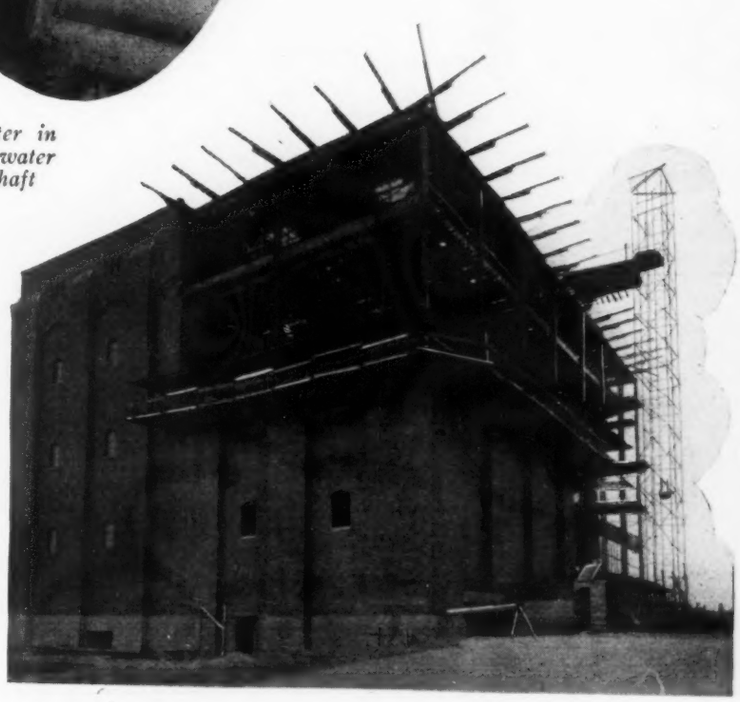
Shaft Leveler Saves Time

IN THE installation of horizontal shaft water wheels and turbines erection engineers for the Pelton Water Wheel Company have devised a simple and extremely accurate means of leveling the shaft. The device, as illustrated, consists essentially of a heavy "V" base supporting a standard inside micrometer of any convenient length, fitted at the upper end with a target containing a cross-hair sight of known distance from the micrometer top anvil, the lower end of the rod resting on the shaft.

The instrument is placed on one end of the shaft and a sight taken on the cross hair with a surveyor's transit located opposite the center of the shaft. The micrometer scale, which is graduated in thousandths of an inch, is then read and the shaft corrected for elevation. The instrument is then moved to the other end of the shaft and the process repeated.

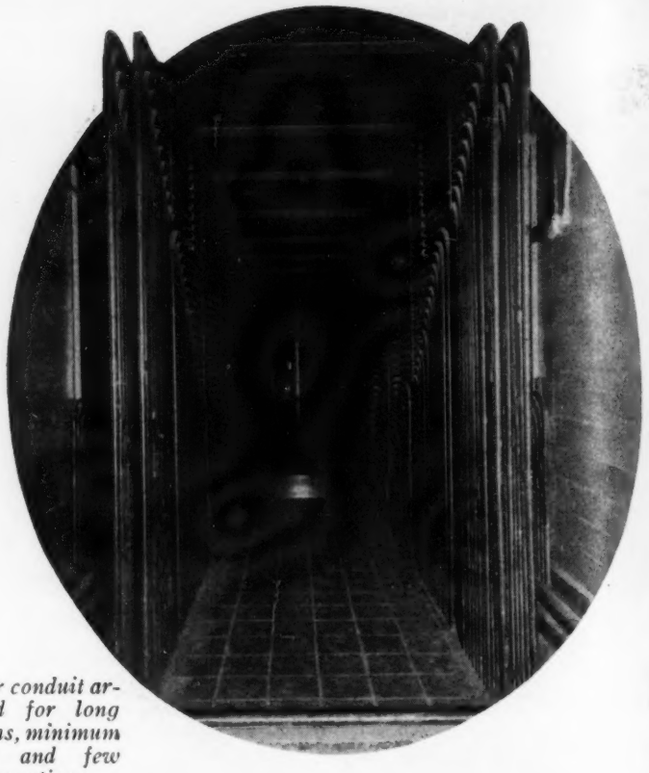
Use of this instrument makes for far greater accuracy in shaft leveling and requires less than half the time needed for methods previously employed. Whereas accuracy to 0.001 of a foot was previously acceptable, this instrument can be read to 0.001 of an inch.

Micrometer in place on water wheel shaft



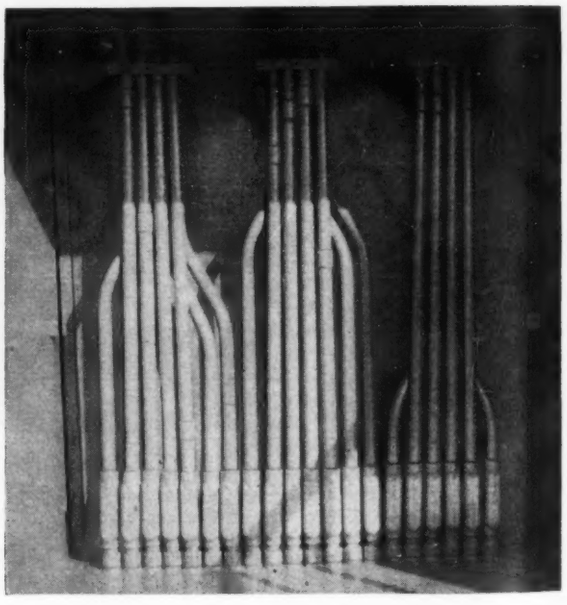
Moisture-Proof Conduit

INSTALLATION of conduit at the Brunot Island switch house of the Duquesne Light Company has been largely arranged so that the collection of moisture will be eliminated within the pipes and so that all conduits will be fully accessible. Manholes have been planned so that the pipes are held by clamps from touching the wall of the structure on the open air side and compound filled condulets are used for the underground ends. This gives better service in that the life of the conduit is not shortened by rusting, the wiring passage is kept free and clear for replacements and conductor insulation is protected.

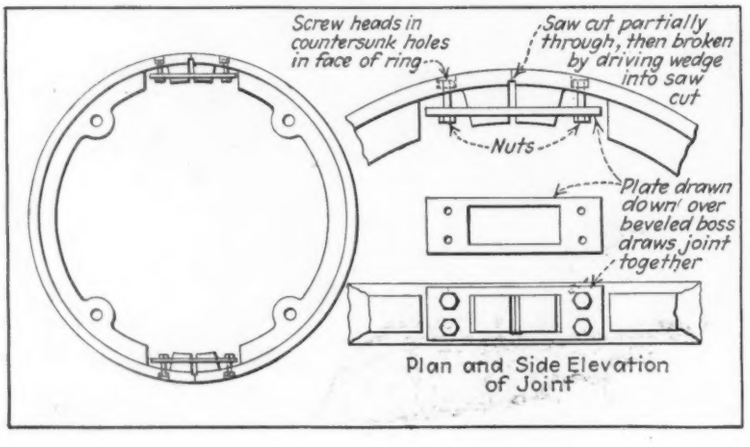


Indoor conduit arranged for long sections, minimum bends and few connections

Orderly outdoor arrangement



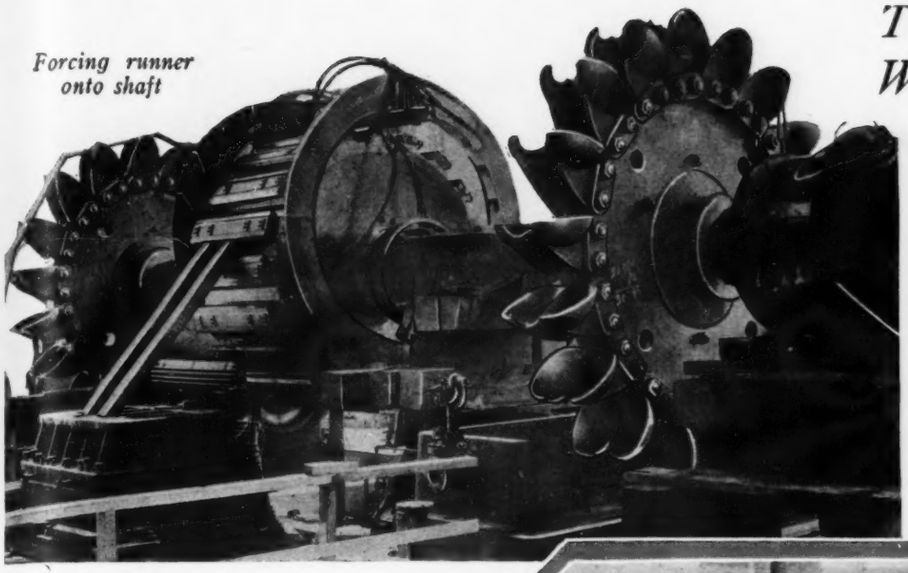
Clamp spacers and compound-filled condulets aid in preventing condensation at manholes


Screw heads in countersunk holes in face of ring
Saw cut partially through, then broken by driving wedge into saw cut
Nuts
Plate drawn down over beveled boss draws joint together
Plan and Side Elevation of Joint

Collector Ring Replacement

WHEN collector rings on generators must be replaced the preliminary work seems quite out of proportion to the actual replacement if integral rings are used. The shaft end must be freed from its bearings so that the old ring may be slipped off and the new one on. The Consumers Power Company uses integral rings, but these have now been cut in half and the ends of the halves fashioned to take a yoke so that changing rings is relatively simple. The joint at the brush contacting surface is perfect and the split ring performs as satisfactorily as the integral one.

Tension Bolt Simplifies Water Wheel Assembly

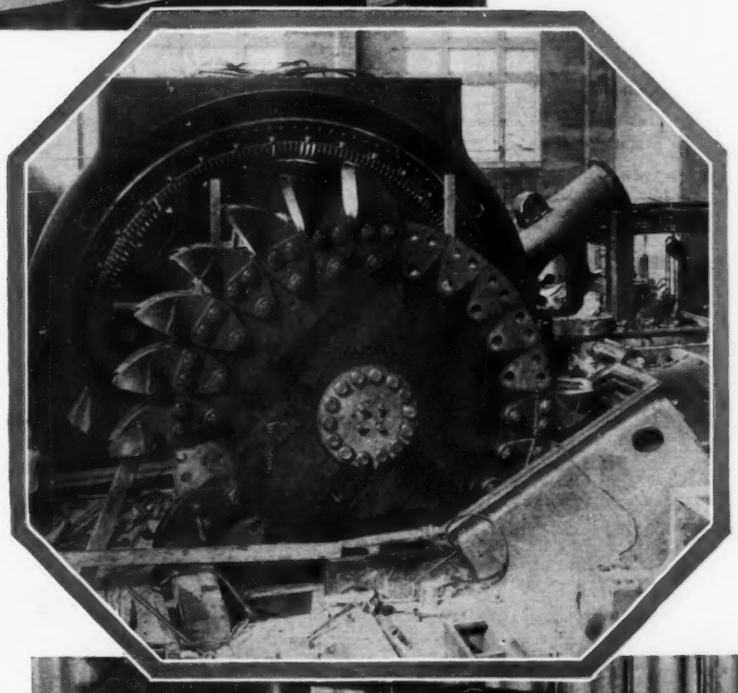


Forcing runner onto shaft

IN FIELD assembly of impulse water wheels long tension bolts and strong-backs have been eliminated by erection engineers of the Pelton Water Wheel Company as a means of pressing water wheel runners onto their shaft. The newer method consists of screwing a heavy tension bolt into the end of the shaft for holding the block against which the hydraulic jacks bear. White lead and oil applied to the shaft, permit a press fit without heating the runner.

Installing Buckets on 56,000-Hp. Wheel

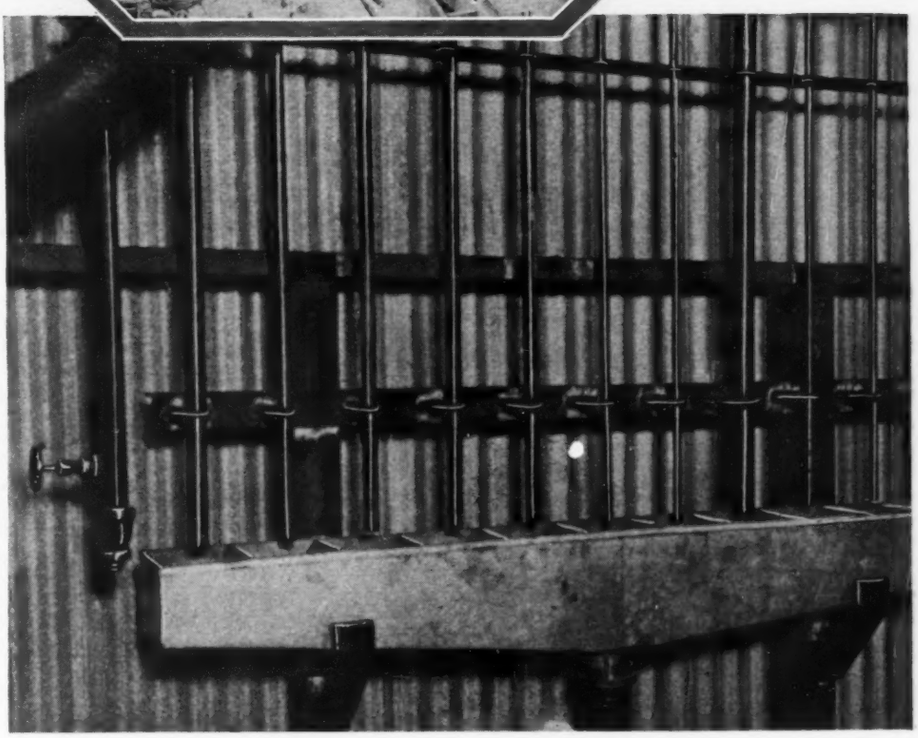
THE unusual size and weight of the buckets on the 56,000-hp., double-overhung water wheels at the Big Creek No. 2-A hydro-electric plant of the Southern California Edison Company made the problem of assembly particularly difficult. An overhead crane was used to hold the ½-ton buckets in place while the retaining bolts were pressed in with a hydraulic press. The crane hook was then used to turn the wheel sufficiently for placing the next bucket.



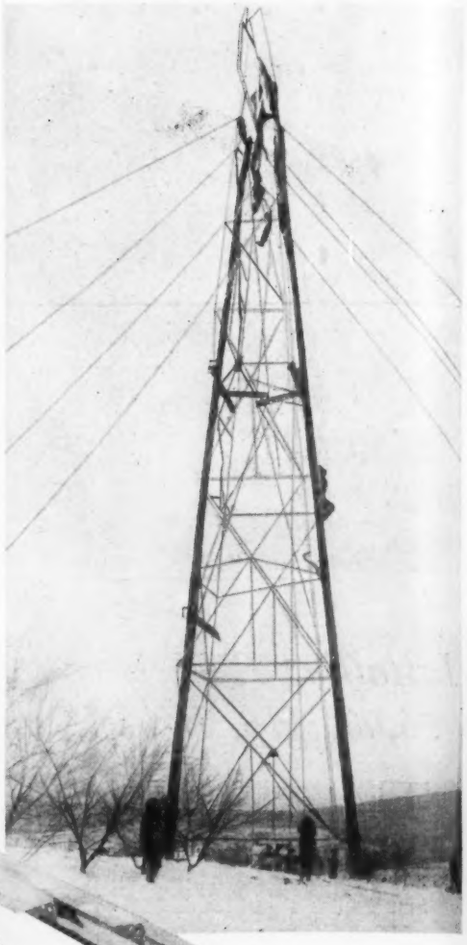
A wood block prevents the wheel from turning due to the unbalanced weight

Grouped Water Drains Save Labor

A CENTRALIZED point for observing cooling-water flow and temperature is established in the new addition to station C steam plant of the Pacific Gas & Electric Company, Oakland, Calif. This enables the operator to check the cooling water for gland seals, bearings, condensate pumps, drip pump and boiler-feed pumps without going to the individual pieces of equipment. Very little more pipe was required to group the drains than to locate them at the various pieces of equipment and this was offset by the common drain for all returns.



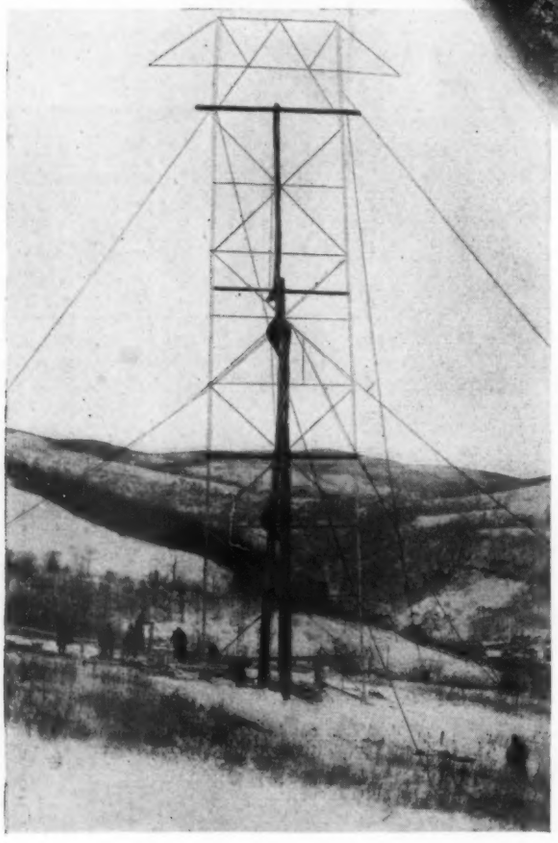
Constructing Transmission Lines for Economy



Lacing in a two-section tower braced for erection

Braced section raised for mid-span tower

Tractor brings tower materials through almost impassable terrain

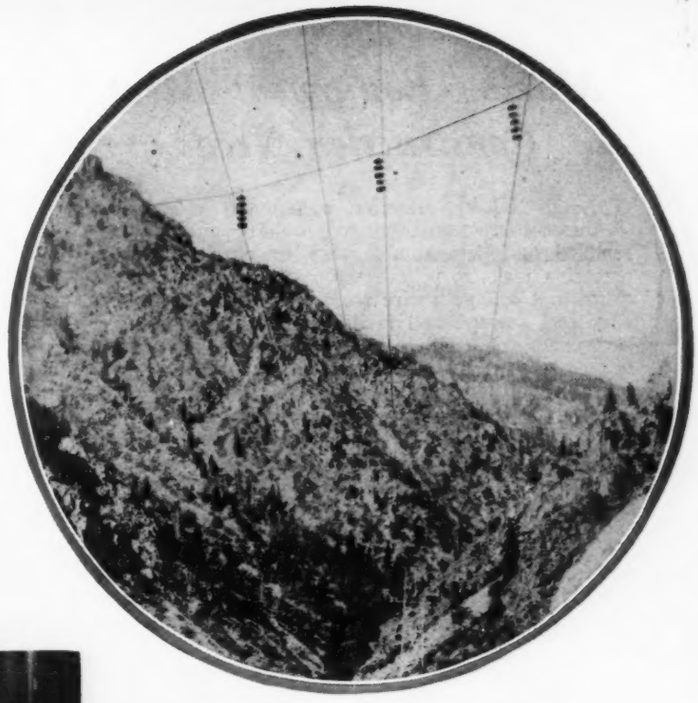


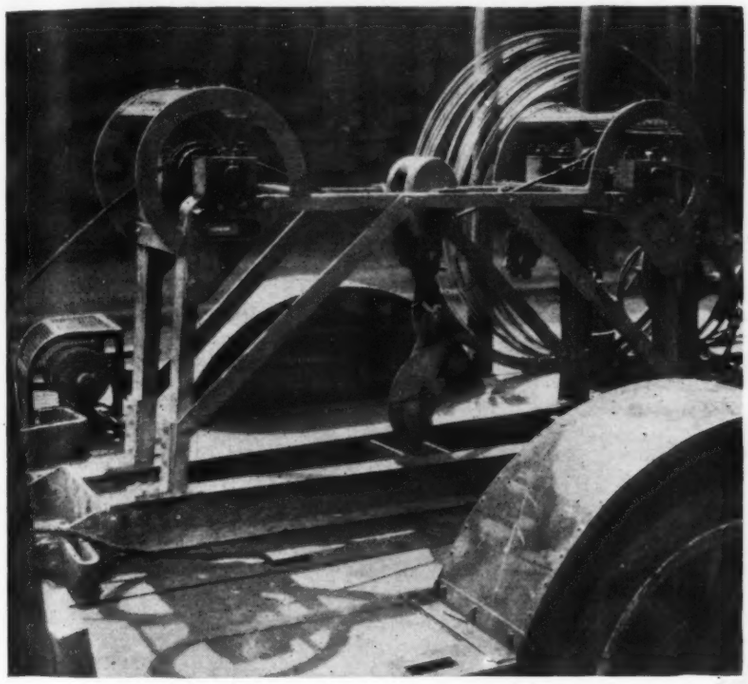
IN ORDER to take advantage of material savings and to reduce erection costs the transmission towers on the Colfax-Highland line of the Duquesne Light Company were assembled on the job in section units and then swung into position. The use of a small tractor and trailer permitted the delivery of materials in clean, undamaged condition in spite of extremely difficult weather and ground factors. Tower sections were bolted together on the ground, braced, as shown in the illustration, with a 50-ft. wood pole to which was lashed a shorter one and with outriggers. This permitted the use of a design sufficiently strong when in place but mechanically unsuited for the stresses involved in swinging into position. The two sections were swung together and then side-laced as indicated, offering a light-weight, economical design made possible by this type of braced-construction erection.

Span-Wire Suspension Replaces Steel Tower

By A. Kanekeberg
Transmission Engineering Department, Public Service Company of Colorado, Denver, Colo.

WHERE transmission lines traverse rugged and mountainous country it is often necessary to find some means of supporting a transmission line where a tower cannot be set or landslides have caused loss of a tower. In such cases the Public Service Company of Colorado uses the span-wire suspension cable consisting of a ⅜-in. plow-steel strand attached to the canyon walls. No trouble has been experienced with six installations of this type over a period of years.





Odometer is on left axle and dynamometer scale below frame near floor

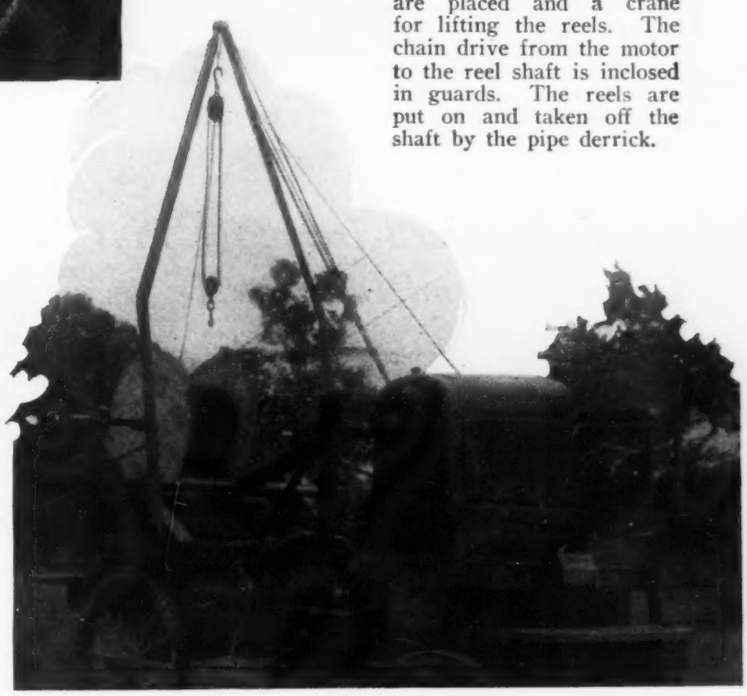
Dynamometer Avoids Cable Strain

SOME of the larger utility companies, notably the New York Edison Company, the United Electric Light & Power Company and the Commonwealth Edison Company, have reduced the cost of underground construction by placing manholes farther apart than is customary. They have investigated the safe pulling tension in cables and the amount of tension required to pull different size cables under different conditions. The dynamometer illustrated used by the United company, shows the pulling tension and the number of feet of cable which has been pulled in.

Power-Driven Wire-Pulling Device

ON THE system of the Wisconsin Power & Light Company there is in use a wire-pulling machine that had a very small first cost and that is returning large dividends in speed and economy. It is used for pulling out old conductors on pole and tower lines and pulling in new. One job that the machine handled successfully and with a considerable saving in labor cost was the replacement of about 240 miles of No. 0 A.C.S.R. on rural lines with No. 0000 A.C.S.R.

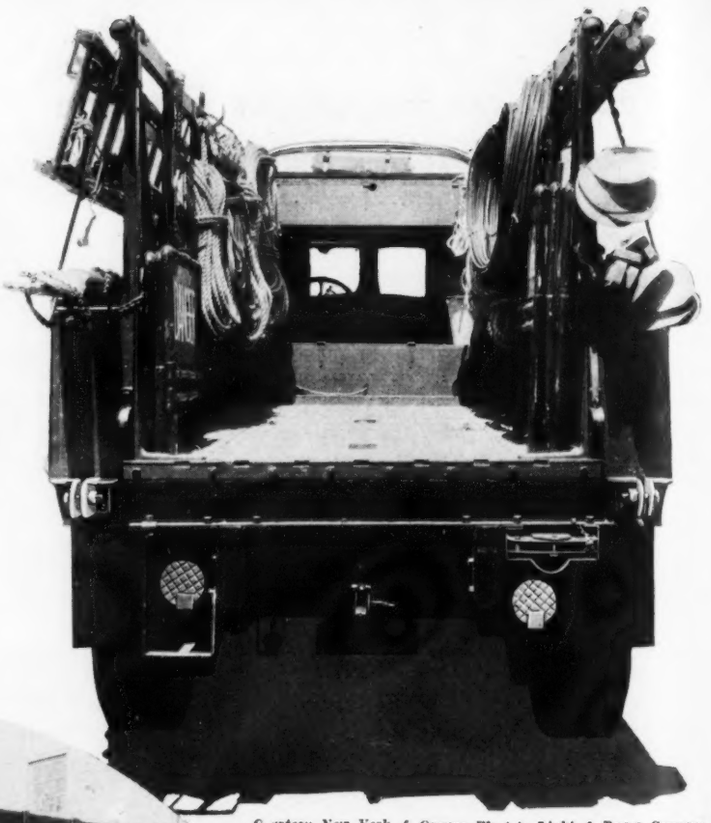
The machine consists of the motor and transmission taken from an old Chevrolet car, a chain-driven shaft on which the reels are placed and a crane for lifting the reels. The chain drive from the motor to the reel shaft is inclosed in guards. The reels are put on and taken off the shaft by the pipe derrick.



Making Equipment Meet Construction Needs

PARTICULAR attention was given in designing this construction truck to providing an easily assembled and demountable stiff-leg derrick, quickly placeable jacks to relieve the truck springs, a winch drum that can pull wire from two directions, accessible tool storage and facilities for quickly filling a kerosene torch. While portable electric flood lamps are used for night work, it is planned to install a spot light on the truck.

The stiff leg is made of two struts fitting in clevises at each side of the truck and two telescoping pieces, one end of which fastens to a king pin on floor. The tension leg is stored underneath the body on the right side. The jacks are hinged to the rear of the body and can be dropped into position when the truck is placed. The body of the jack telescopes and has a pin for locking it in any position. When a weight is lifted by the derrick the truck springs give slightly transferring the weight to the jacks.



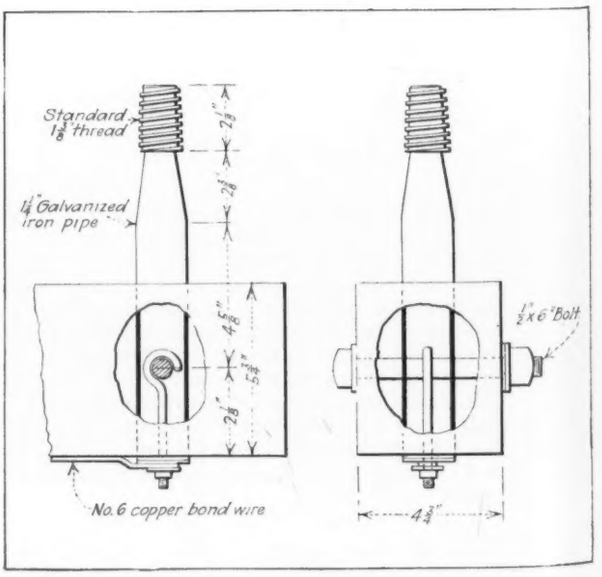
Courtesy New York & Queens Electric Light & Power Company

Winch head projects from side of truck, permitting pulling of wire or transformer hoisting. This has permitted saving 30 per cent of time and labor required for manual pulling. The truck can be moved even when jacks are on ground

Galvanized-Iron Pipe Pins Found Inexpensive

COMPARATIVE costs of various type pins for 11-22-kv. lines has led the Great Western Power Company, San Francisco, to adopt as standard a pin made of 1¼-in. hot-dipped galvanized-iron pipe with threaded lead thimble. Dimensions of the pin are given in the accompanying drawing; the length of the pin depends on the operating voltages. The hook shown is used effectively to bond the pin and through-bolt to prevent static discharges which might cause radio interference.

In large quantities the pins cost 25 cents each; the hooks 5 cents each and the ½x6-in. through-bolts 3 cents each, making the total cost 33 cents.

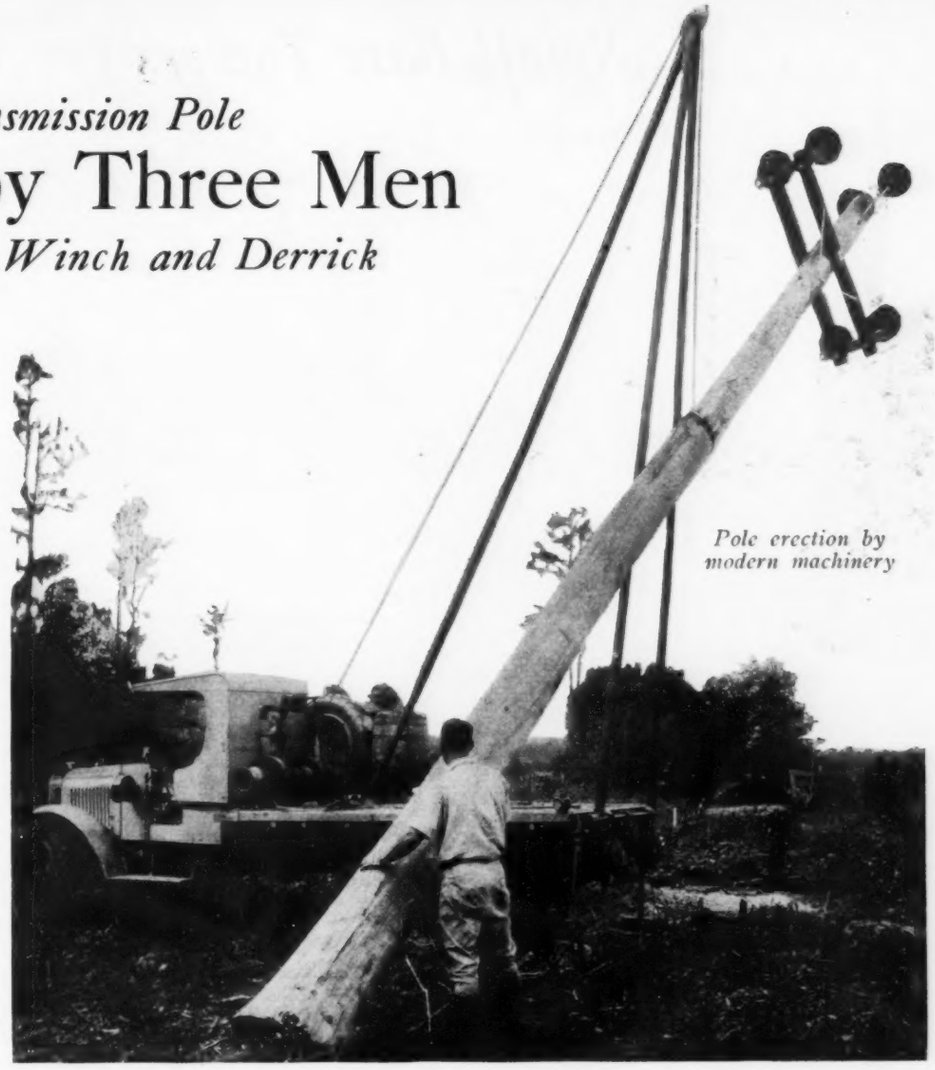


Transmission Pole

Erected by Three Men

with Power Winch and Derrick

HUNDREDS of miles of transmission lines are built yearly by the Hoosier Engineering Company with the aid of power-driven winches and pole derricks. The accompanying illustration shows a pole being set with a Mead-Morrison jaw clutch winch and a 55-ft. pole derrick, only two men and a driver being required for the job. By hand, with the pike pole method, eight men are required, as shown in the companion view. Insulators are installed prior to erection of poles, when using modern power machinery.

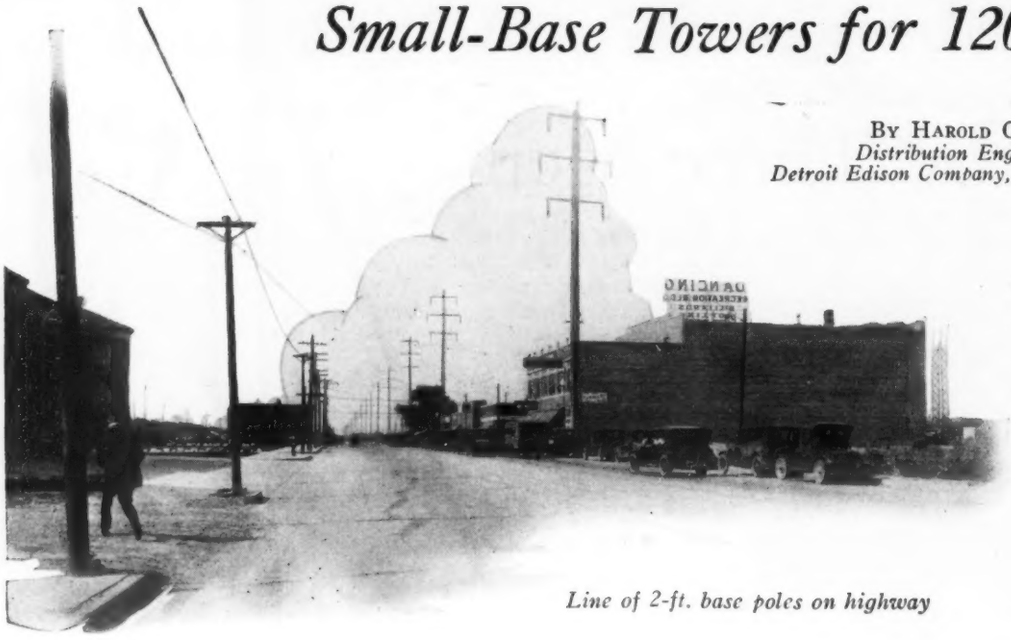


Pole erection by modern machinery

Setting a pole by hand required eight men on this job

Small-Base Towers for 120-Kv. Line

By Harold Cole
Distribution Engineer,
Detroit Edison Company, Detroit, Mich.



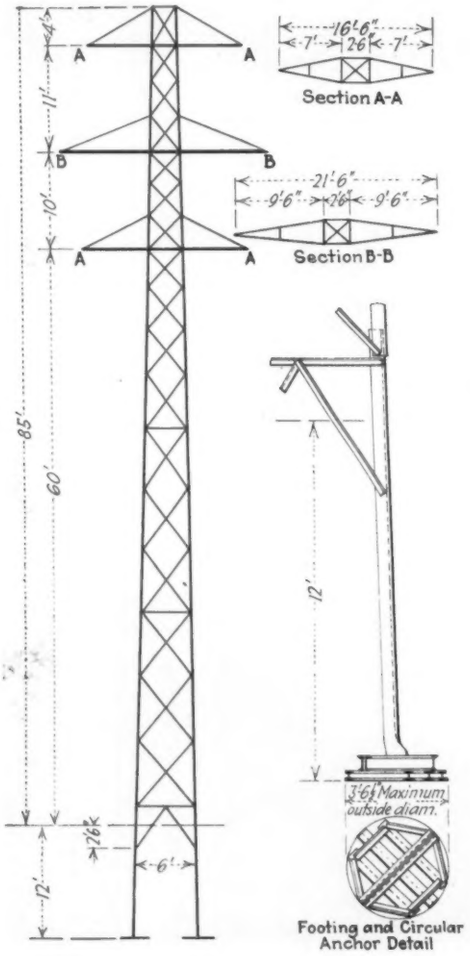
Line of 2-ft. base poles on highway

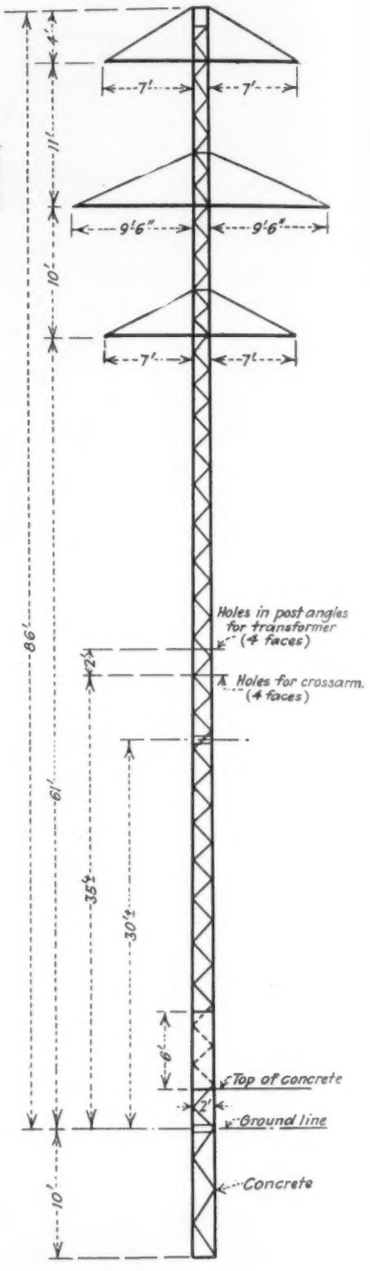
SAVING money by spending it is not in these days the paradox that it would have been some years ago. By building a number of miles of 120-kv. line at costs of $25,000 per mile in one case and $15,000 in another, the Detroit Edison Company was able to effect major economies even though these figures differ greatly from the normal cost of $10,000 to $12,000 per mile of ordinary 120-kv. lines, excluding right of way.

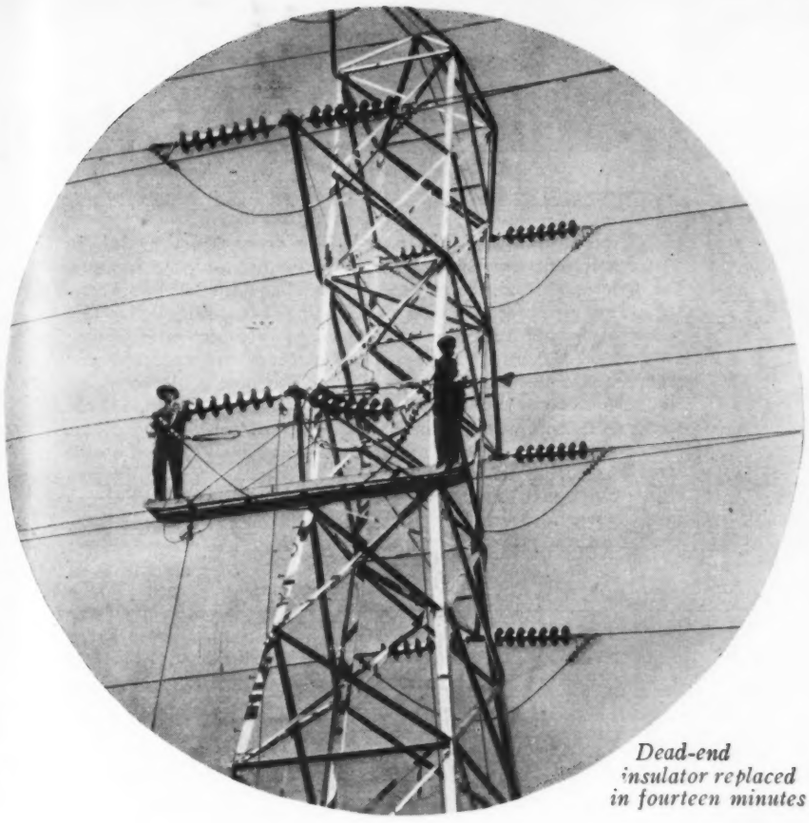
The lines might have been carried over much longer routes, or they might have been of standard construction over the actual routes taken and at a greatly increased cost for the necessarily wider right of way, if it had been possible to get it at all. Alternative routes and wider rights-of-way were conspicuously absent. There was no other outlet than to put 10 miles of 120-kv. line on city streets and 11 miles on the right-of-way of an interurban electric railway.

In the one of construction employed there is a two-circuit tower 96 ft. long, 10 ft. of which is in the ground. This tower has a base 2 ft. square and it is installed just inside the curb line of the street like any ordinary pole. The holes were dug with an earth-boring machine to a depth of 11 ft. by a 40-in. auger. A template resting over the hole supported the pole in position and with its end 1 ft. from the bottom of the hole while concrete was poured in and allowed to set. The concrete was carried up inside the pole structure about 3 ft. and a steel plate was placed over the angle bracing to a sufficient height to discourage the climbing propensities of small boys. These poles are spaced 300 ft. apart and carry six No. 3/0 hard drawn copper conductors and one ground wire of the same size and material. They weigh 10,500 lb. apiece, not including the weight of concrete. At about ordinary wood pole height (35 ft.) above ground the pole steel is drilled for the reception of crossarms to carry a street lighting circuit and provision is made for the installation of ornamental lighting fixtures on the poles. The upper illustration shows on the right a complete line at a point where it crosses one of the main radial highways out of Detroit.

The second type of special construction makes use of a tower 85 ft. high with a base 6 ft. square instead of the ordinary 15 to 18 ft. The towers are essentially the same as the standard in design and they were installed in conformity with the usual Detroit Edison practice except that the base being narrower the footings must go deeper. The holes for the legs were bored with an earth auger to a depth of 12 ft. and the footings are the patented grillages furnished by the American Bridge Company. These towers are erected in place, a crew of eight men putting up one tower in about five hours.







Dead-end insulator replaced in fourteen minutes

Making Repairs with Minimum Help

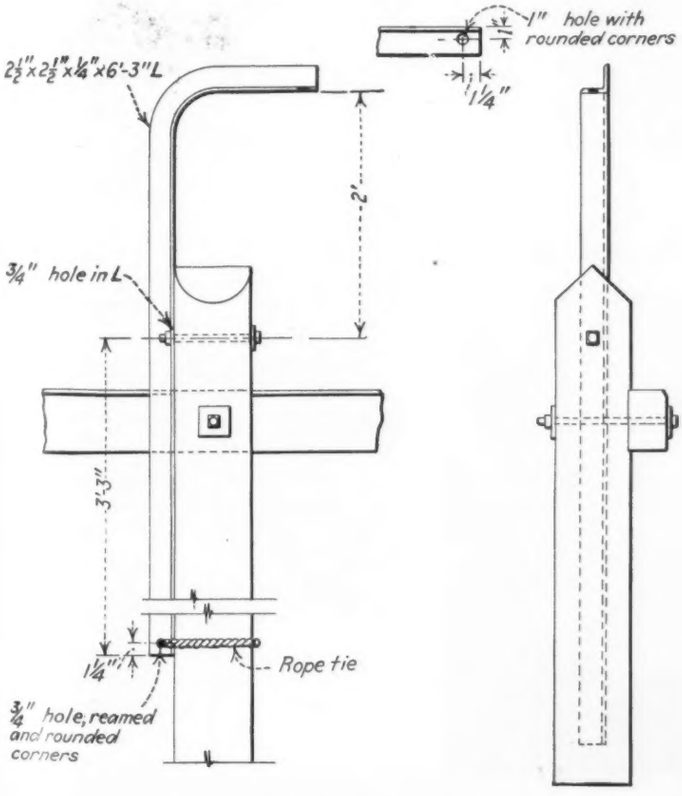
IN THE Rocky Mountains, at elevations of 5,000 to 13,700 ft., the weather conditions are extremely severe, so that the Public Service Company of Colorado has been forced to adopt maintenance methods which enable patrolmen to make repairs with the minimum of help and danger. The working platform and slack puller illustrated constitute the method used for making repairs or replacements to a dead-end installation.

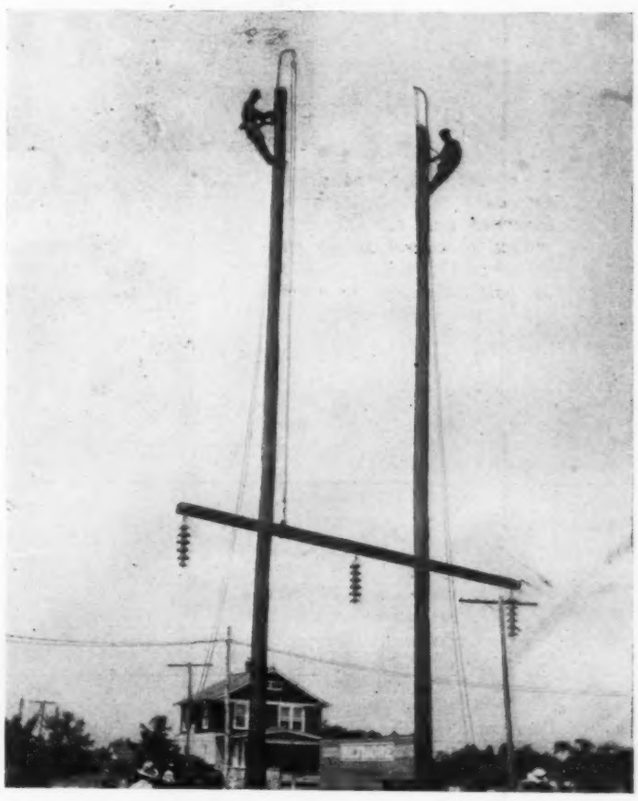
A. Kanekeberg, of the transmission engineering department of this company, points out that the platform is readily hoisted into place by a hand line and chained to the crossarm. Each end is anchored to the base of the tower, so the platform is safe even in high winds. Linemen attach their safety belts to the tower so that if they accidentally step off the platform they will be caught by the belt.

The slack puller is crank-operated and has sufficient gear reduction so that one man can produce a tension of 10,000 lb. in a conductor. Its use dispenses with heavy blocks and luff lines in insulator replacement work.

Heavy Crossarms Raised Easily

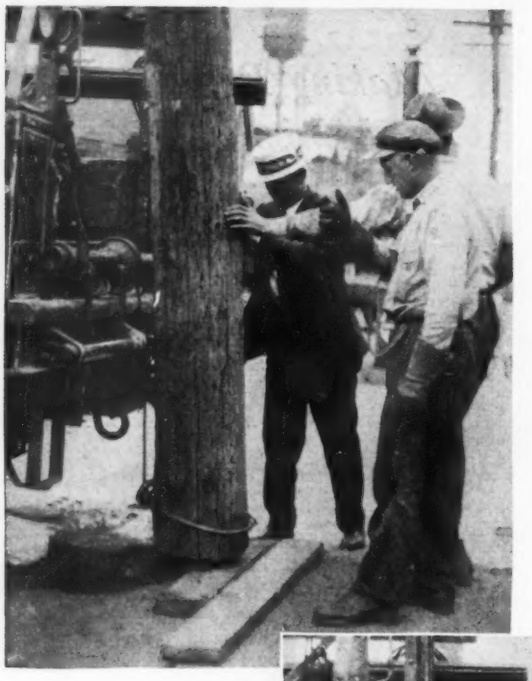
A GOOSENECK of steel angle construction is used effectively in erecting 110-kv. crossarms on the Virginia Electric & Power Company system, according to F. G. Dana, superintendent of construction for Stone & Webster. The arms employed in H-pole construction on the Richmond-Fredericksburg line are 6 in. x 8 in. x 26 ft. in dimensions and weigh about 500 lb. each. These are too heavy to handle manually, so two goosenecks are used per structure, as illustrated. Each gooseneck is bolted to the pole near the top and rope-tied 3 ft. 3 in. lower down. No extra attachments are put on the pole, the upper bolt being a through bolt which prevents the pole from cracking. A small block and falls is attached to the upper end of the gooseneck and the arm is easily raised by pulling from the ground with one man on each pole to guide the arm into place and attach it with insulators already in position.

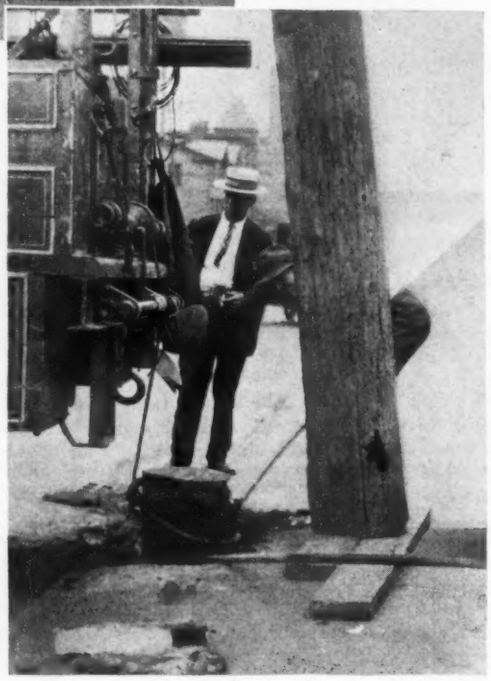




Rehabilitating W

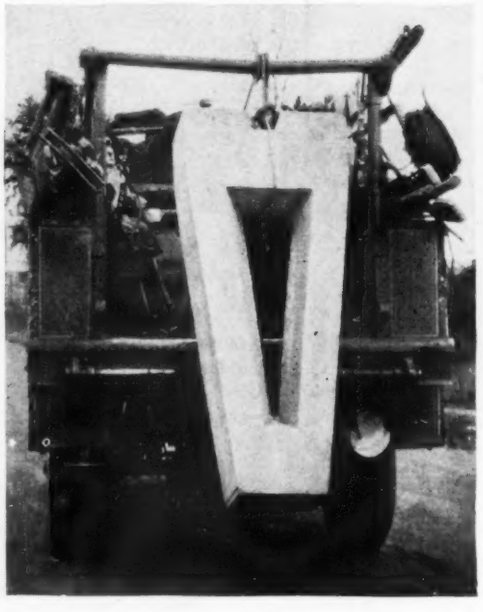
IMPORTANT steps in a pole-line reconstruction job in Connecticut are illustrated. By the use of pole mounts, the pole section above ground is saved for further long-continued service after the decayed butt has been removed. The work of rehabilitation is accomplished without interrupting service on the line. No overhead changes are required and linemen are needed only for guying the pole and removing the guys after the construction has been finished. This method is employed in both new construction and maintenance activities. The job illustrated was performed on a city street, resulting in marked savings in time, labor and material. On one Connecticut job the saving through elimination of overhead wire changes reached $300 for a single pole. On an ordinary line like that shown the saving per pole runs far below this, but the elimination of overhead wire changes and of the interruption hazard is generally clear gain. The pole mount shown is of the Williams type, manufactured by the Malleable Iron Fittings Company.



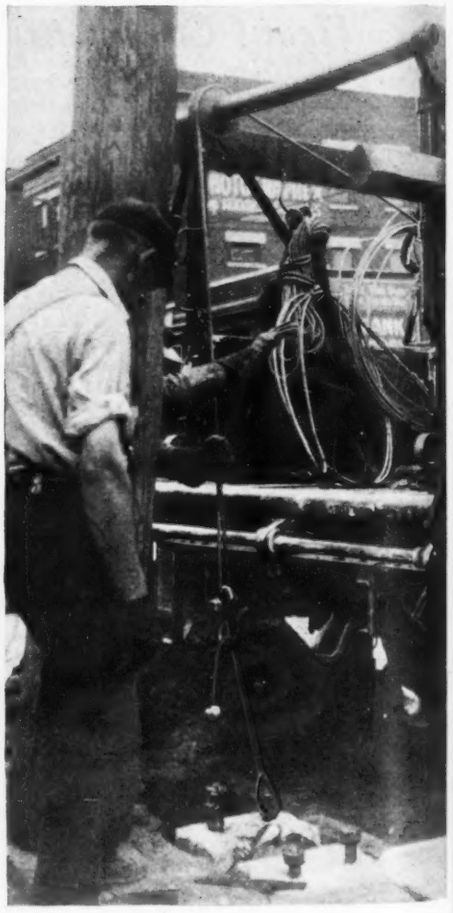


Pole has been sawed off above ground line and is being set back from old butt onto plank rest to prevent caving in of hole when butt is withdrawn. During sawing the weight of pole was carried on truck winch line to prevent saw binding. An alternative method is to drive a wedge into the saw kerf

Pole butt being pulled by truck winch. Earth loosened and partially removed to lessen strain on truck and winch. Tripod or pole jack can be used when desired



Precast concrete base with anchor bolts cast in position suspended on back of truck prior to backing up to hole. Meanwhile hole has been enlarged slightly to accommodate base



Precast base in place ready for placing of pole and attachment of malleable-iron pole mount

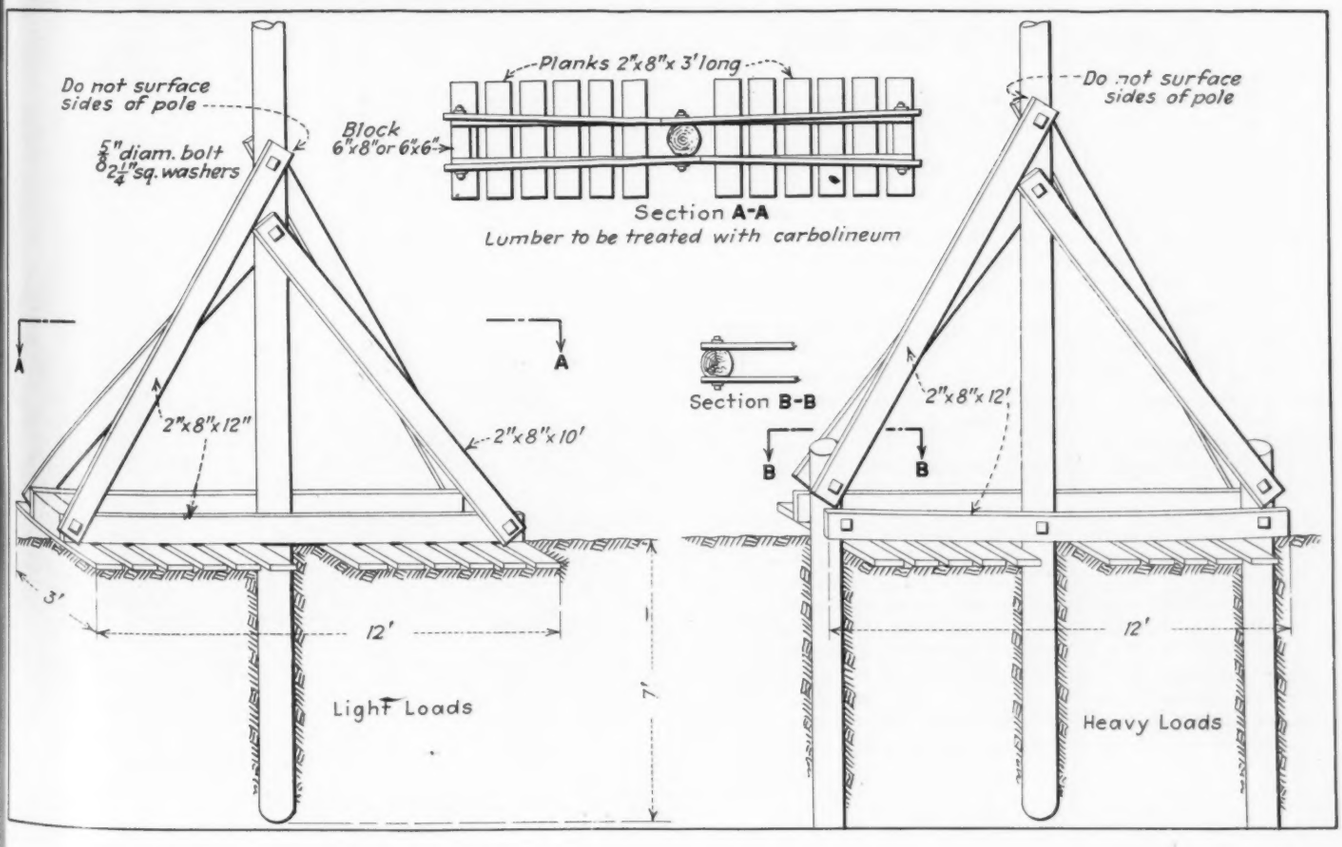
Wood-Pole Lines *without Interrupting Service*

Pole being set back into position on top of concrete base from 2 to 3 in. above sidewalk level

Sidewalk repairs have been made and guys removed. Slots in the base of the pole mount permit 6-in. adjustment for diameter of pole

Pole Setting for Swamp Land

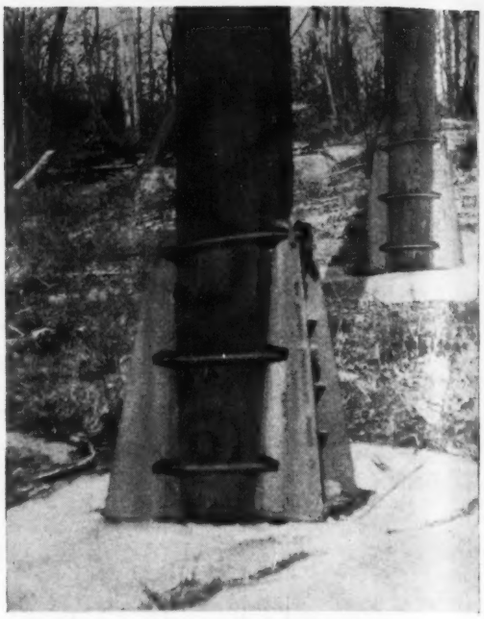
(Standards of American Gas & Electric Company)



Important H-frame pole mounts on semi-floating piers

Supporting Poles on Rocky and Marshy Land

ON THE Meriden-Montville 66/110 kv. line of the Eastern Connecticut Power Company, pole mounts were effectively used where substantial foundations were demanded. In one case two boulders were utilized in their natural position as foundations for H-frame construction with two poles at different levels. Williams pole mounts support the poles, the anchorage being by bolts expanded into holes drilled in the boulders. No blasting was required and full-treated pine poles nearly 10 ft. shorter than otherwise would have been required were erected. It is estimated that on this job at least $15 per pole or $30 per bent was saved in comparison with the cost of blasting in cases where the latter would have been necessary without the pole mount type of construction.



Blasting eliminated by use of pole mounts on rock foundation

In a swamp on the same line the use of pole mounts afforded satisfactory footings. Here the mounts are set on semi-floating concrete piers, a coffer dam being required to keep the site clear enough of water to permit the pier construction.

Earth-Boring Machine Reduces Digging Costs One-half

USE of a light-weight earth boring machine mounted on a four-wheel trailer has reduced pole-digging costs for the Pacific Gas & Electric Company in one of its districts, by more than 50 per cent over hand digging. This saving is based on 419 holes varying in depth from 5½ to 7 ft., about 85 per cent of which were 5½ ft. deep. Soil in the district ranges from loam to extremely resistant hardpan which required blasting in some cases under hand-digging methods.

The machine is equipped with a 7-ft. boom and helical six-tooth cutter driven by a 12-hp. gasoline engine. Feed lever and throttle are so mounted that the drill may be backed up to a pole for boring a stub hole if desired. The equipment is also used for sinking anchor holes.

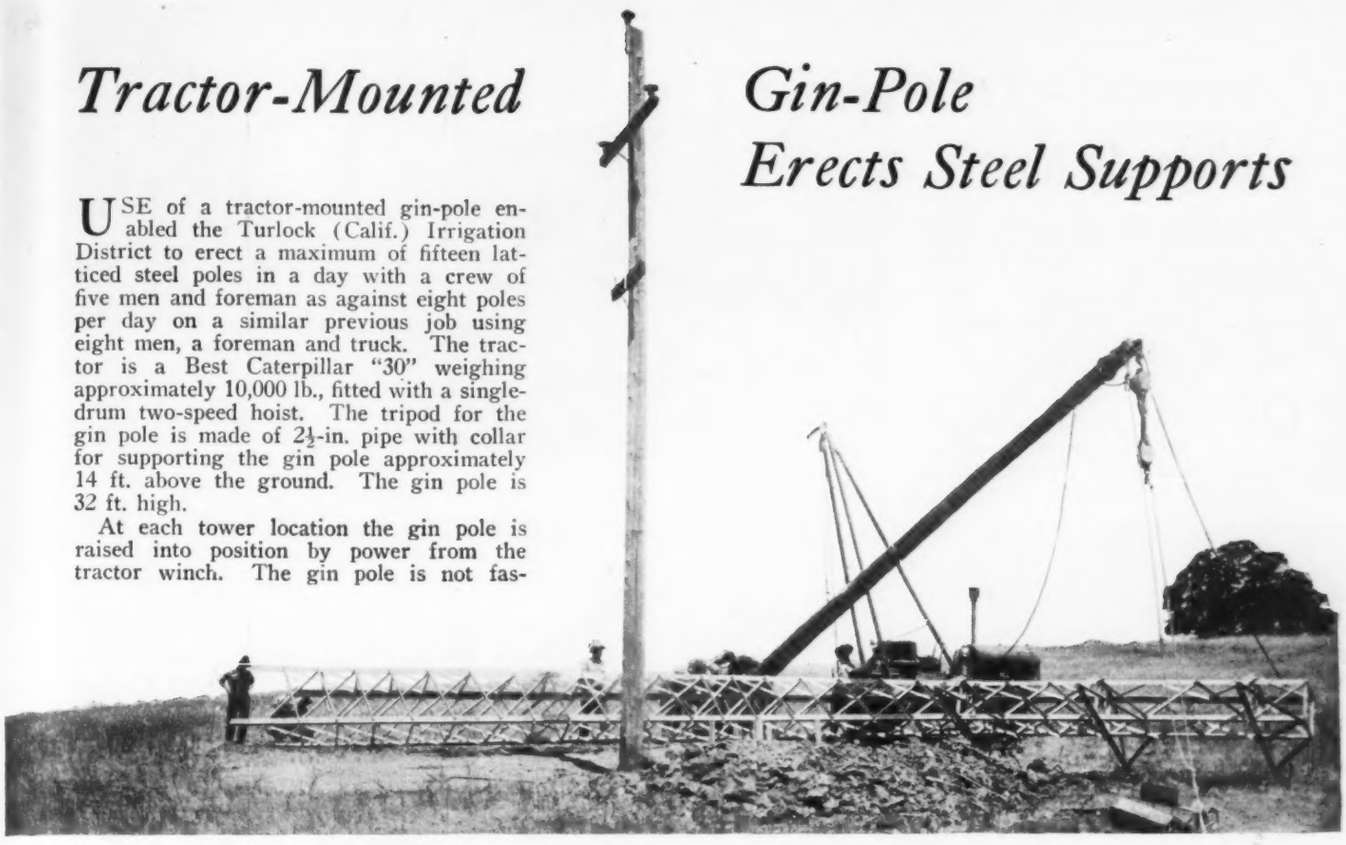
Several such light mobile earth-boring machines have been purchased by the Pacific Gas & Electric Company for use on small jobs in place of the larger and more powerful type of diggers used in general construction work, which carry a high fixed charge because of their initial cost. An analysis of total costs for the small machines show that they will more than pay for themselves the first year. In one district the small boring machine has been placed on a Ford truck for sinking pole holes in the country district served. Another California utility using similar equipment has added a gin pole to the outfit so that a pole may be set at the same time the hole is dug.

Two men operating small earth-boring machine. Costs show that the machine will more than pay for itself the first year

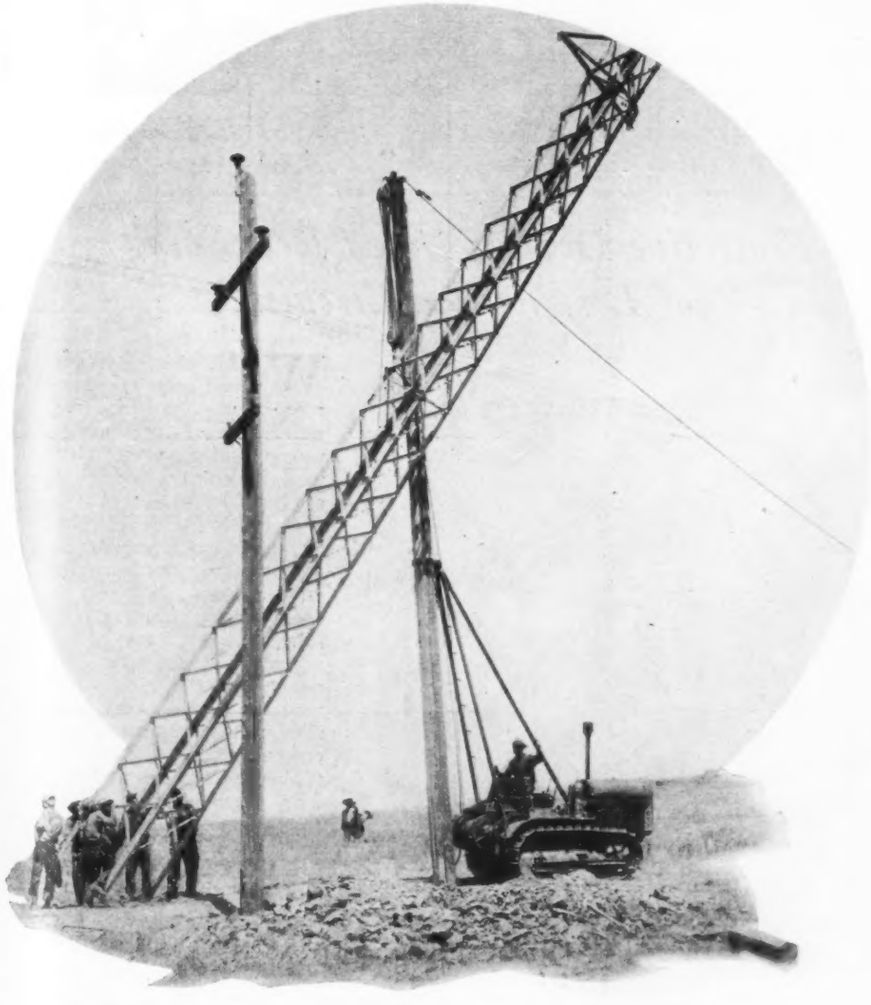
Tractor-Mounted Gin-Pole Erects Steel Supports

USE of a tractor-mounted gin-pole enabled the Turlock (Calif.) Irrigation District to erect a maximum of fifteen latticed steel poles in a day with a crew of five men and foreman as against eight poles per day on a similar previous job using eight men, a foreman and truck. The tractor is a Best Caterpillar "30" weighing approximately 10,000 lb., fitted with a single-drum two-speed hoist. The tripod for the gin pole is made of 2½-in. pipe with collar for supporting the gin pole approximately 14 ft. above the ground. The gin pole is 32 ft. high.

At each tower location the gin pole is raised into position by power from the tractor winch. The gin pole is not fastened at the base during the erection, but merely stands on the ground without further support at this point. This equipment was used for erecting 29 double- and 71 single-circuit steel poles. The double-circuit poles are 59 ft. long, weighing 2,910 lb., while the single-circuit poles are 55 ft. long and weigh 1,560 lb. Guy ropes were unnecessary during the erection of the single-circuit poles, but were found to be an advantage in erecting the heavier poles. A set of blocks was required in raising the double-circuit poles, whereas the lighter poles were hoisted directly by the winch.



Practically double the number of poles were erected per day with this equipment compared with using a gin pole and auto truck



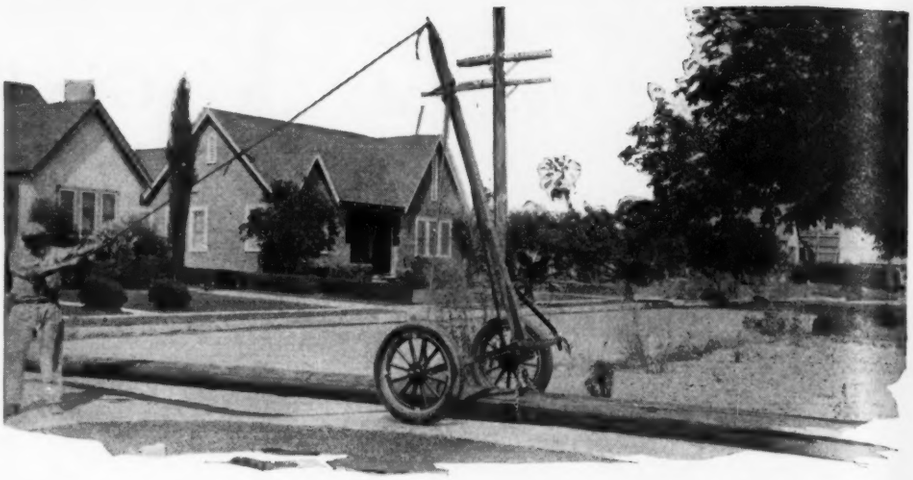
CONSTRUCTION COSTS FOR 14 MILES OF 70-KV. LINE
(29 Double-Circuit Steel Poles and 71 Single-Circuit Steel Poles)

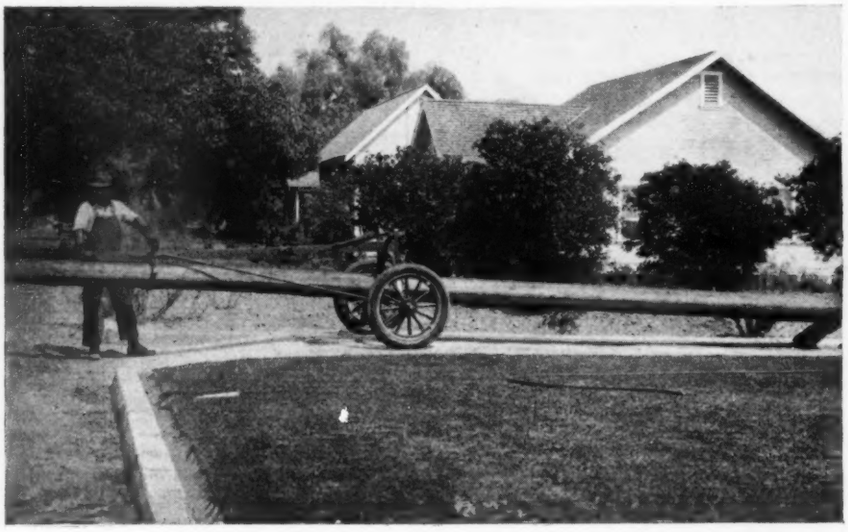
	Total Cost	Cost per Mile
Labor digging poles and placing foundation..	$4,922.34	$351.59
Hauling poles, wire and insulators	2,727.30	194.80
Concrete mix and cement	5,140.00	367.15
Erecting and assembling poles.	1,878.26	134.16
Stringing wire and insulating	2,391.89	170.05
Steel Poles.....	12,583.17	898.73
Conductors (No. 1/0 seven-strand copper)	19,730.00	1,409.27
Insulators and hardware	4,750.00	339.28
Total cost.....	$54,122.96	
Total cost per mile.....		$3,865.03

Pneumatic-Tire Pole Dolly Protects Lawns

By W. P. Chapman
Division Superintendent Distribution Department, Southern California Edison Company, Los Angeles, Calif.

ONE of the difficulties encountered by the Southern California Edison Comany in se' ting distribution poles for rear prop



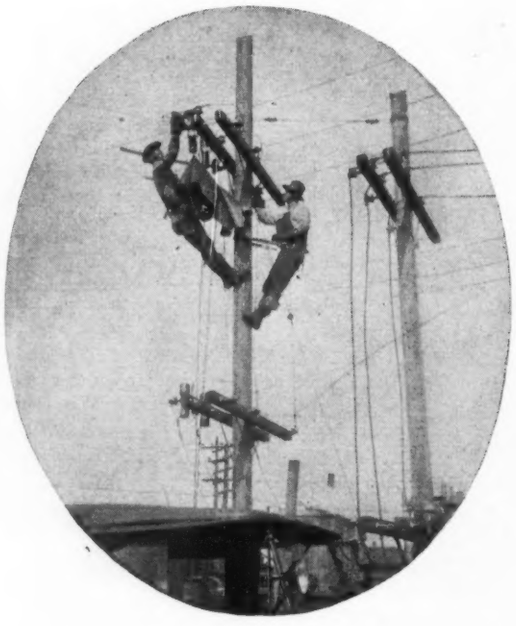


Transporting distribution material to rear property lines. Top—Method of loading a pole. Left—Pole loaded under trailer. Right—Carrying a transformer on removable platform

erty lines was to get the poles and line equipment to the rear of customer's property without damage to lawns, flowers and shrubbery. The trailer, or dolly, illustrated was built from discarded Ford parts and the wheels equipped with pneumatic tires, which makes possible pushing the trailer across a lawn with a 40-ft. pole without damaging the lawn and at the same time rendering the job less difficult. Poles up to 40 ft. in length may be handled with ease by two men.

The dolly is made still more useful by the use of a detachable platform designed to fit over the axle, permitting loading a transformer with two men and transporting it to the foot of the pole with ease. The equipment also is used as a trailer and when only one pole is needed on a job it can be trailed behind a 1,500-lb. truck without damage to the truck. Because of the design of the trailer the pole can be unloaded directly from the trailer into the hole with much less labor than with the ordinary pole dolly.

Protective Devices Aided Rebuilding of Distribution Circuits



WORK which involves rebuilding of lines more often than not requires that service be maintained and linemen must work the circuits while they are hot. In Alliance, Ohio, recently the Ohio Public Service Company charged a considerable portion of its circuits from 2,300 volts to 6,900 volts without service interruption to any of its industrial customers. In doing this the men were required to take every possible safety precaution and extensive use was made of rubber protective devices. The accompanying view shows rubber blanket, hose and gloves in use while linemen were working on a 6,900-volt circuit.

33-Kv. Line Moved 19 Ft. Alive

A LINE of 35-ft. poles carrying a three-phase, 33-kv. circuit and a single-phase circuit was recently moved 19 ft. with one circuit alive by the Public Service Company of Northern Illinois. According to S. H. Mosher, supervisor of construction, rope side guys were first attached to the pole to be moved. A skidway consisting of a 2-in. x 10-in. plank was laid from the pole to the new hole. The pole was jacked out and set on the end of the plank, then pulled over with a block and tackle hitched to the butt, the skidway being liberally lubricated with clay and water. The pole was lowered into the new hole with an 8-ft. A frame.

One pole was moved at a time without untying the conductors from the insulators. The amount of slack required for a movement of even this distance is comparatively small—a lateral movement of 19 ft. in a 150-ft. span requires only about 13 in. of slack. This slack is easily obtainable in such a span due to the flexibility of adjacent poles.

By this method transportation, raising and handling of poles in yards were entirely eliminated. The time required to move the entire line was not much more than would have been needed to transfer the conductors to new poles. On this particular job nine men, including the foreman, moved eight to twelve poles per day, depending on tree conditions.

If the company had employed the usual method of moving a pole line this distance, namely, setting all or alternate new poles, transferring conductors, and removing old poles, the expense would have been double, it is estimated. Hand labor was found more satisfactory than mechanical means because it was imperative that the operations be performed smoothly and slowly.

Pulling the pole over on the skidway

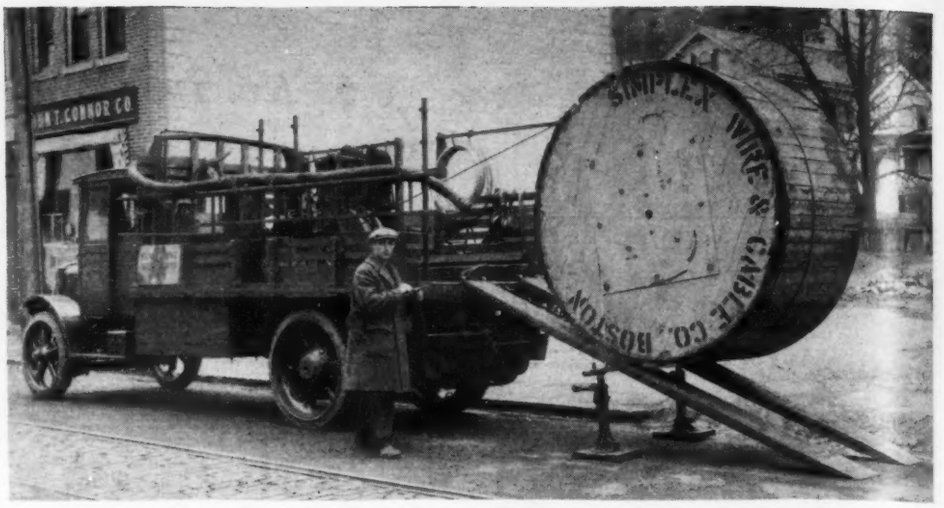
Dropping the pole in the new hole

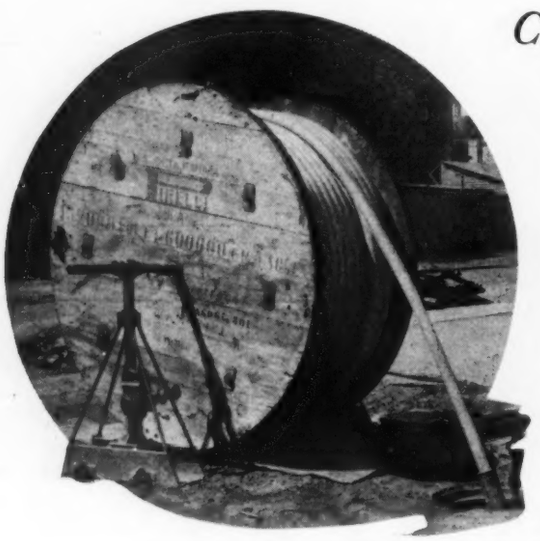
Truck Facilitates Distribution Changeover

BY RECONSTRUCTING the distribution facilities in the business section of Montgomery, Ala., it was possible to remove 40 miles of conductor. Indispensable lines were erected on tubular steel poles furnished by the Electric Railway Equipment Company. Wrecking of the old system was undertaken at night with the aid of a White gin-pole truck. While the pole was held by the truck, the wires were stripped, the butt sawed off and the crossarms removed. According to E. K. Leary, Alabama Power Company, the truck more than paid for itself in six months by the saving of labor.

Two Men Load Cable Reel

ANOTHER example of the economy of the modern power winch in underground construction work is afforded by the practice of the Malden (Mass.) Electric Company as shown in the illustration at the right. One man and the driver load the 4-ton reel upon the truck in less than half the time that six men consumed with the old hand methods. A Mead-Morrison winch actuated by the truck motive power is used.





TO FACILITATE moving reel jacks into place and also to permit shifting them along the line of cable pulling, the United Electric Light & Power Company has equipped them with casters.

Conduits Laid Under Tree Roots

By F. E. Sawyer
Power Engineer, Salem (Mass.) Electric Lighting Company

IN A recent conduit-laying job at Salem a twelve-duct line with a cross-sectional area of about 4 sq.ft. was installed by Fred T. Ley & Company, contractors, without damaging the roots of a row of silver maple trees. While the cost of doing the work in this way was somewhat greater than had the roots been cut, the preservation of the trees was considered sufficiently important from the civic and public relations viewpoints to warrant the increase.

Premixed Concrete Reduced Conduit Cost 37½ per Cent

THE Great Western Power Company and other utilities of California have effected substantial savings in constructing conduit lines by contracting to have the concrete poured at so much per yard. The dry ingredients are placed in the hopper of a 3-cu.yd. truck-mounted mixer at the contracting firm's yard and exactly the correct amount of water is carried in tanks on the truck. Upon arrival on the job the water is allowed to run into the hopper and the truck's motive power is used to operate the mixer.

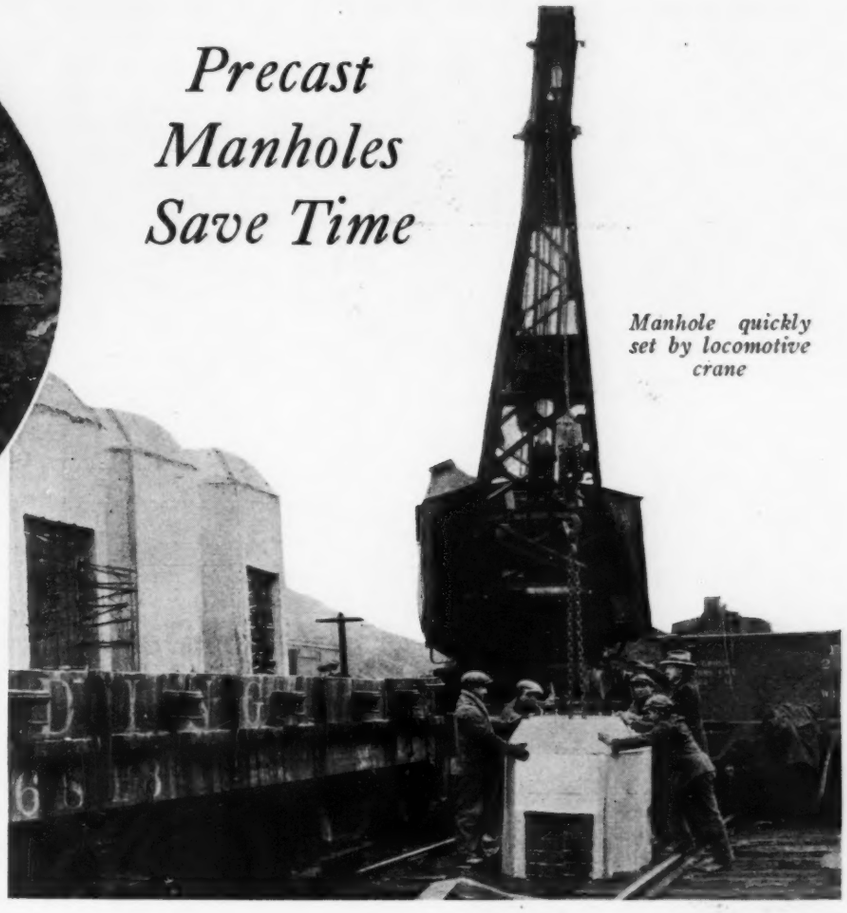
On a recent twelve-duct conduit line the Great Western Power Company contracted to have the concrete poured into the trench for $7.80 per yard, a figure only slightly more than the sand, gravel and cement would have cost if the company had mixed the concrete on the job. On the basis of an estimated cost of $12.50 per yard, had the company done the work itself, a saving of 37.5 per cent was effected.

Precast Manholes Save Time

Economy a feature of precast manhole

"OVERBUILDING" of the tracks of the Reading Railway by the 66,000-volt transmission lines of the Philadelphia Electric Company necessitated the placing of the railroad's signal and communication system underground. This required the installation of a conduit line consisting of various arrangements of twelve to sixteen ducts and 106 manholes. Work was carried on under the difficult conditions attendant upon the frequent passage of trains.

Manholes made of precast concrete and furnished with end openings to admit of duct entrances were used. Openings in the side walls of the manholes for lateral connections were made by removing a "knockout section." The manholes, delivered on the job on flat cars, were unloaded by a locomotive crane.



Manhole quickly set by locomotive crane

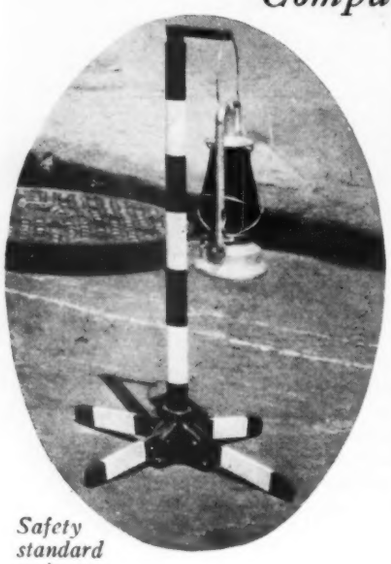
Tractor Backfiller Replaces Labor

THIS outfit eliminates extensive handling of backfill material and permits prompt restoration of traffic, according to C. H. Shaw, engineer of distribution and installation New York Edison Company. The backfilling scoop may be elevated by the overhead wheel to conform with ground conditions. The tractor is also equipped with a windlass and clutch on the rear axle for withdrawal of rubber forms used in constructing ducts.

Special Trailers Avoid Jacking Cable Reels

BY UTILIZING a special cable reel trailer, the Edison Electric Illuminating Company of Boston saves about 75 per cent of the time ordinarily required to jack a reel into position over a manhole for feeding cable into ducts. Open-slotted bearings receive and hold the reel pipe axis, after the bearing has been hooked under the reel axis by raising and then lowering the left-hand end of the frame. The use of reel jacks is eliminated by this device.

Compact Warning Standard



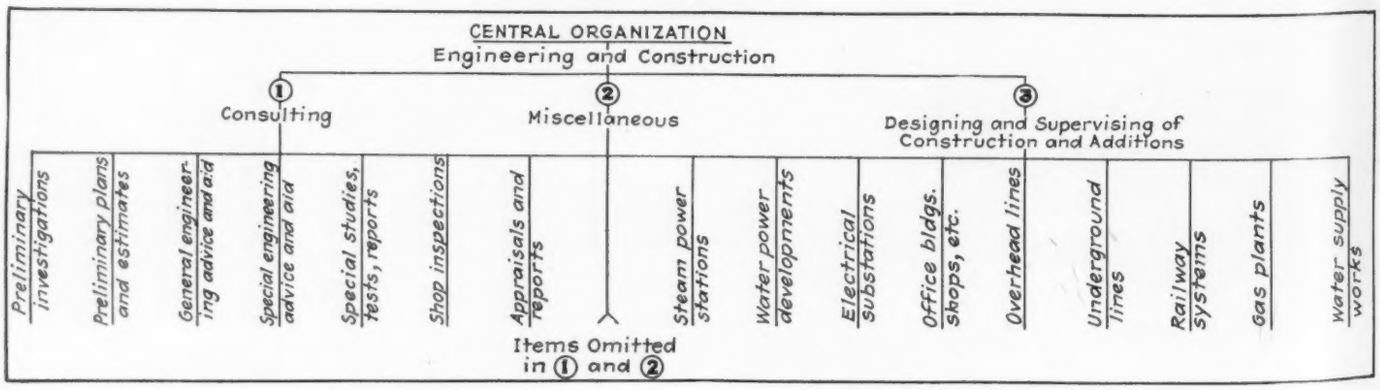
Safety standard as it appears at night

TO PROTECT the public around construction work and to avoid collisions with construction material the New York Edison Company has standardized on a folding flag and lantern warning standard which folds into a compact form so it can be readily stored. Black and white stripes are painted on the marker to make it conspicuous. The vertical member is hollow and threaded at the top to receive a reversible plug, in one end of which is fitted a short flagstaff. Attached to the other end is a hinged hook for supporting a lantern. When not in use the legs of the stand fold up against the center stand and the flag is rolled and screwed in the housing. The standard is made by the Engineering Products Corporation.

Safety standards guarding an open manhole, in the daytime

Organization for Engineering and Construction

FROM the engineering and construction service clauses of an Eastern management company contract the accompanying diagram has been prepared to show the subdivision of work in these activities of the central organization and its clients. Three major divisions of engineering and construction activity are indicated: Consulting, designing and miscellaneous engineering. In general, the consulting work applies to normal or routine engineering in connection with existing plants and systems, with particular reference to additions, extensions and alterations and to operating matters. Appraisals are included in connection with court, commission or other proceedings which require property valuations.



Lowering Transformer Into Vault

THE chain-block support is constructed so that it can be easily dismantled for handling. Eyes are provided in gusset plates on the legs to permit attachment of hooks or lines where the supports must be moved into or out of relatively inaccessible places.

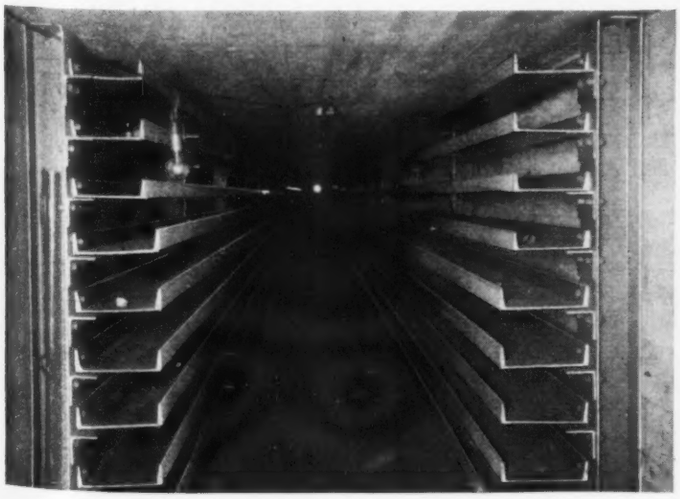
Courtesy United Electric Light & Power Company

Dip Method Cuts Use of Compound 50 Per Cent

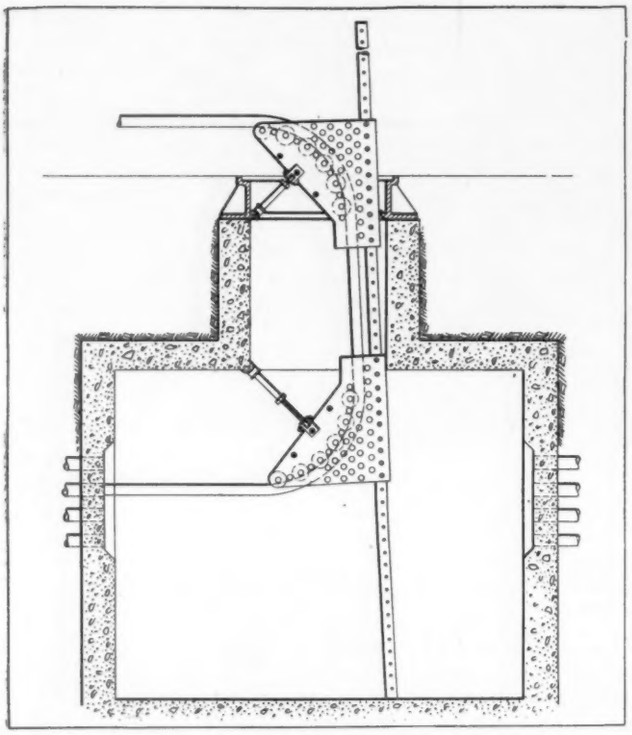
BY PROVIDING its underground construction forces with pails equipped with a metal ring and canvas protector, supplemented by a guide on the bottom around which the circular ends of fiber conduit can be set in dipping into preservative compound, the Cumberland County Power & Light Company, Portland, Me., saves 50 per cent of the compound formerly consumed by the open dip or brush application plan. The conduit section is always placed in the proper position by this means and surplus compound wiped off as the duct is withdrawn from the pail.

Improved Cable Racking

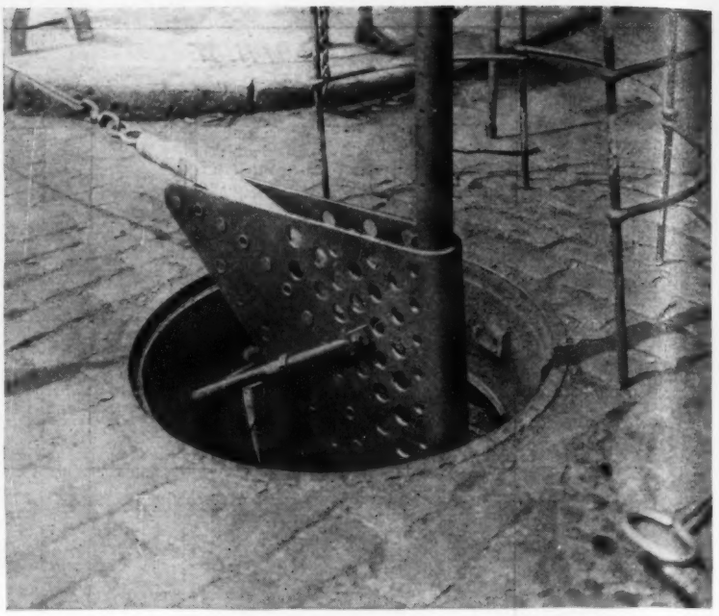
TWO innovations in cable-racking practice were used by the Byllesby Engineering & Management Corporation in the construction of the Brunot Island switching station of the Duquesne Light Company, Pittsburgh, Pa. Flame-proof cables were racked on structural channels in the north tunnel, thus eliminating the necessity for duct lines or trench placements, and offering a neat, readily accessible arrangement with economy features. The lead-covered outgoing feeders in the Brunot Island station are carried on arm racks, adjustable for various heights, and readily moved. The vertical angle iron is drilled at regular intervals and bolts are used to attach the arms to the column. These racking features have proved economical in erection and maintenance considerations.



Pulling Device Prevents Cable Damage



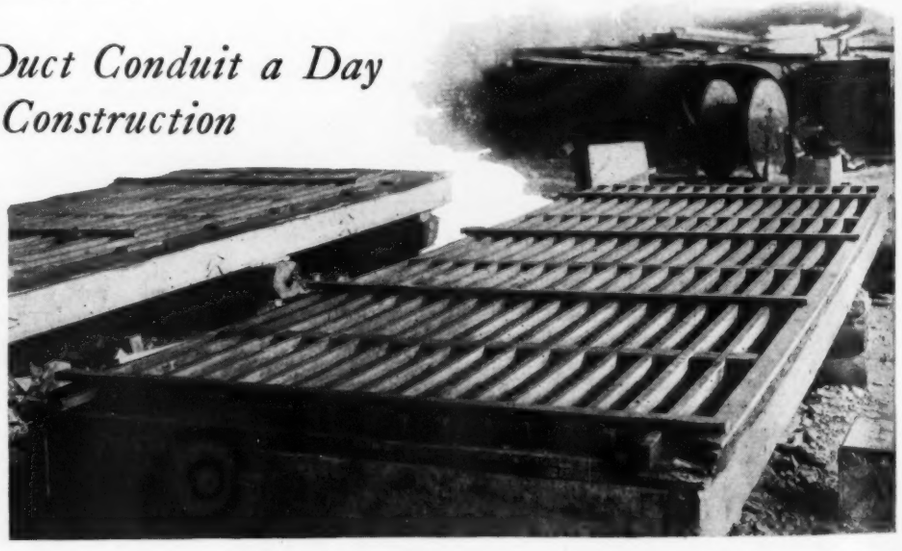
Cross-section of manhole shows location of cable puller and method of bracing



TO PREVENT damage to cables while pulling them into or out of a duct the United Electric Light & Power Company, New York, has developed a device which is adjustable and which imposes the minimum stress on the cable. The curvature to which the cable must conform is the same above and within the manhole. The sheaves are easily adjusted so the direct pull is horizontal. With this device 450 ft. of 350,000-circ.mil, three-conductor cable installed in a 3½-in. duct was recently removed easily without any injury to the cable.

Building 125 Ft. of 16-Duct Conduit a Day with Monolithic Construction

UNTIL lately the Cumberland County Power & Light Company, Portland, Me., built its conduit lines one row at a time. For example, if the conduit was 4 wide x 4 high, the bottom row of ducts would be laid in the concrete, then the second row and so on. The present practice is to lay all the ducts before any concrete is placed. Proper separation is obtained by concrete spacers. By using monolithic construction 125 ft. of sixteen-duct line can readily be laid under average conditions in an 8-hr. day.



Reinforced concrete spacer rods precast in shop

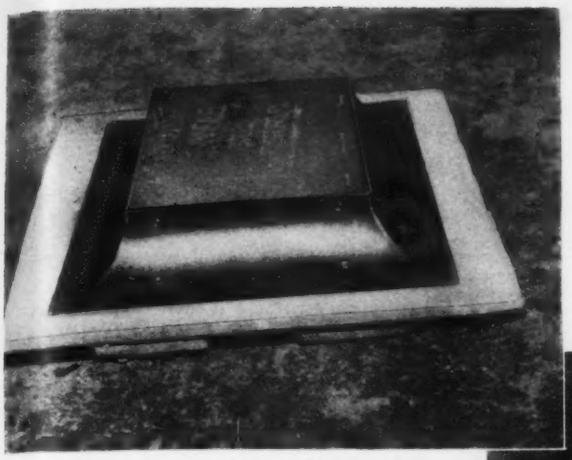
Cable-Reel-Turning Device

A ONE-MAN cable-reel-turning device affording safety and speed is used by the United Electric Light & Power Company, New York. The device is made from pipe fittings and a U-shaped piece of strap-iron. A telescoping leg makes the unit adaptable to various-size reels. In operation, the end of the lever made from short pieces of pipe is slipped into the center of the cable reel. The long lever arm is then raised until the desired fulcrum is obtained, when one man can easily hitch the cable reel in the position wanted.

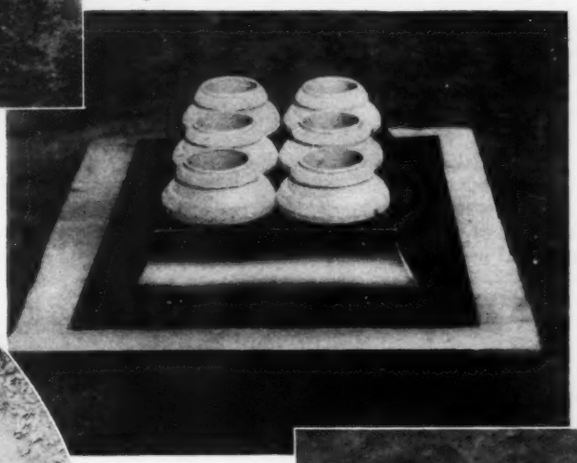
Precast Duct Entrances

at Fall River

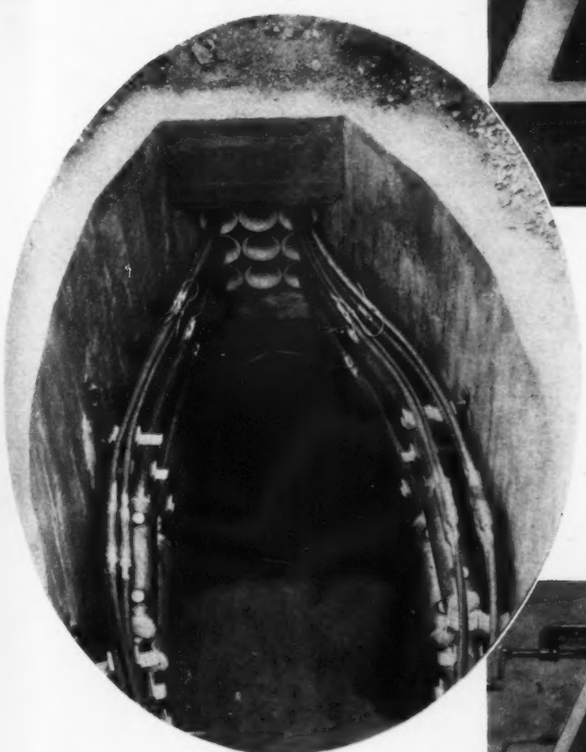
Improve Underground Service



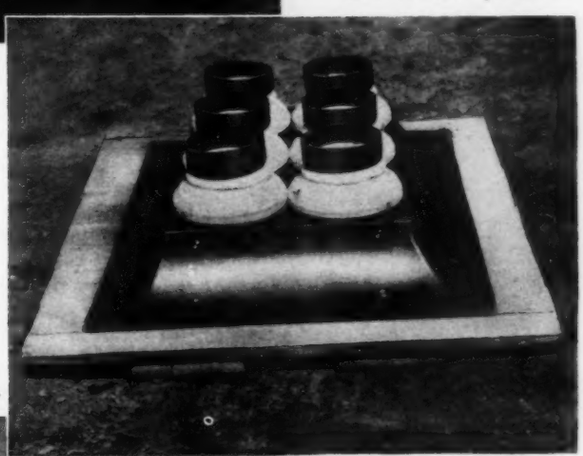
Adjustable steel form with wooden top can be arranged for any desired shape and spacing



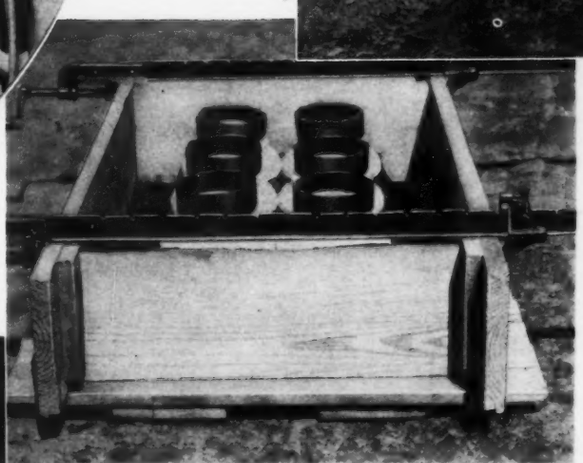
Rectangular form spaced for six ducts



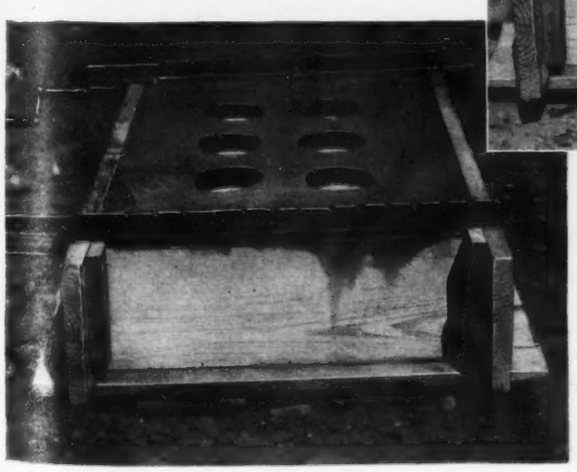
Manhole with duct bells installed after casting. When installing bells in manhole occupied by cables the bells are split and cemented in place.



Bell lips with half slip couplings ready for insertion in wooden box form



At left—Detachable box form ready for pouring

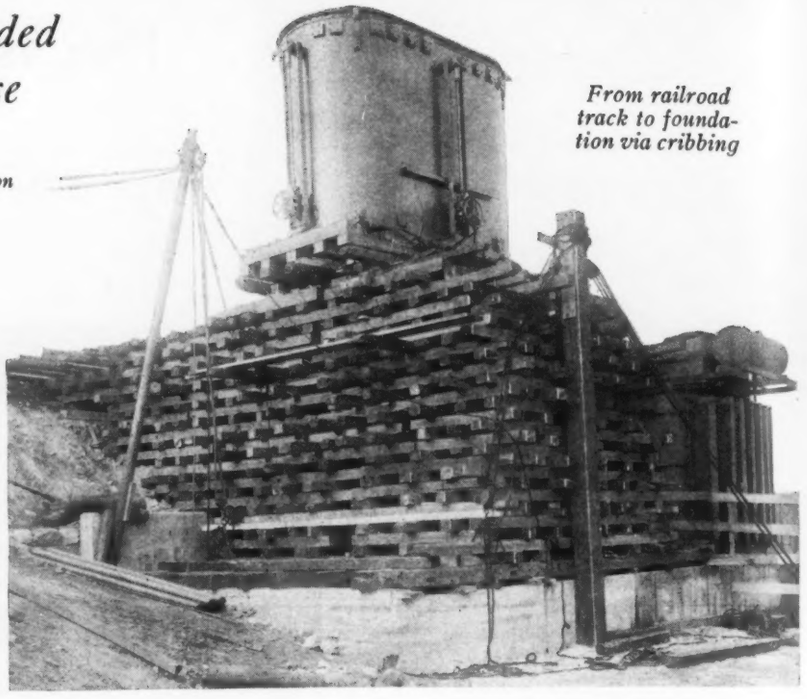


Bottom — Box form after pouring concrete

REFERENCE to the reduction of cable sheath troubles on the system of the Fall River (Mass.) Electric Light Company by the use of Line Material Company precast duct entrances was made in the ELECTRICAL WORLD Jan. 14, 1928, page 102. This company has had about tsixteen months' experience with this type of work, and O. G. Beauregard, superintendent of underground lines, states that about 75 manholes have now been provided with these cable entrances at an average cost not exceeding 1 per cent of the manhole under concrete construction. Sheath troubles due to duct edges have been eliminated.

64-Ton Transformer Unloaded at Half Expected Expense

By Wellen H. Colburn
Edison Electric Illuminating Company of Boston



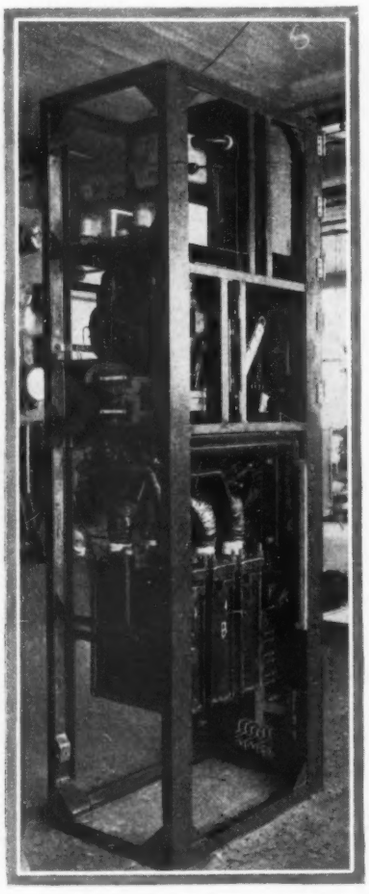
From railroad track to foundation via cribbing

RECENTLY the engineers of the Boston Edison Company faced the problem of moving an 18,000-kva., three-winding transformer, weighing 64 tons shipped, from the car to its foundation at the Roslindale substation. The nearest siding of the N. Y., N. H. & H. R.R. was 1¾ miles away. In general, the road surfaces were good and well-consolidated, tar-bound macadam or concrete-grouted paving blocks, but the route crossed a heavily traveled parkway and traversed business and traffic arteries. A 95-ft. difference in elevation existed between the siding and the street at the front of the substation, and there was 17 ft. between the street and the ground at the rear of the building.

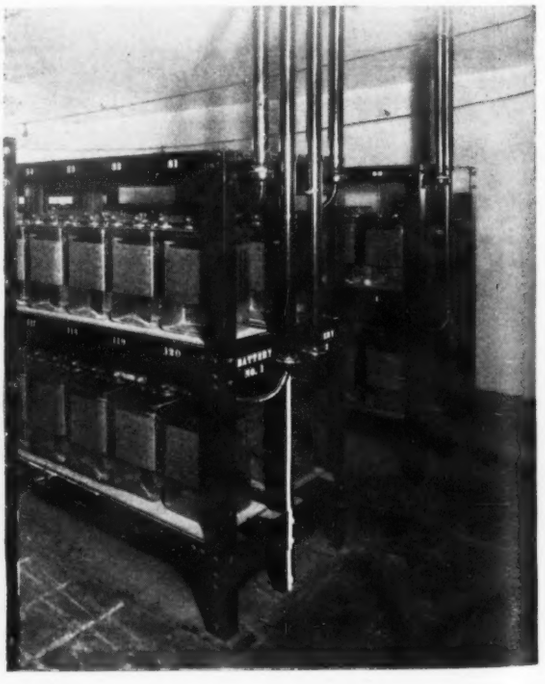
It was thought that a substantial saving could be made over the bid for the work by following a procedure in which the railroad and the contractor wholeheartedly co-operated. The grade of the railroad which passed directly behind the station was 14 ft. above the top of the foundation with an intervening bank 3 ft. higher. The railroad placed the car bearing the transformer on the inbound track directly behind the substation and opposite the foundation after the passage of the last train, shortly after midnight. Meanwhile all possible preliminary work had been done at the site. The removal of the transformer was carried out so expeditiously that the line was clear five hours later, in time for the passage of the first train in the morning. The transformer was then moved over to a point above its final position and jacked down to the foundation, a little over two days being required.

About 200,000 board-feet of timber of sizes ranging from 4x6 in. to 12x12 in. and from 6 to 30 ft. in length, and rolls 8 in. in diameter were used, all of which was furnished by the contractor from his regular stock.

The total cost of these operations indicated a saving of over 50 per cent of the expected cost of teaming the transformer from the railroad siding.



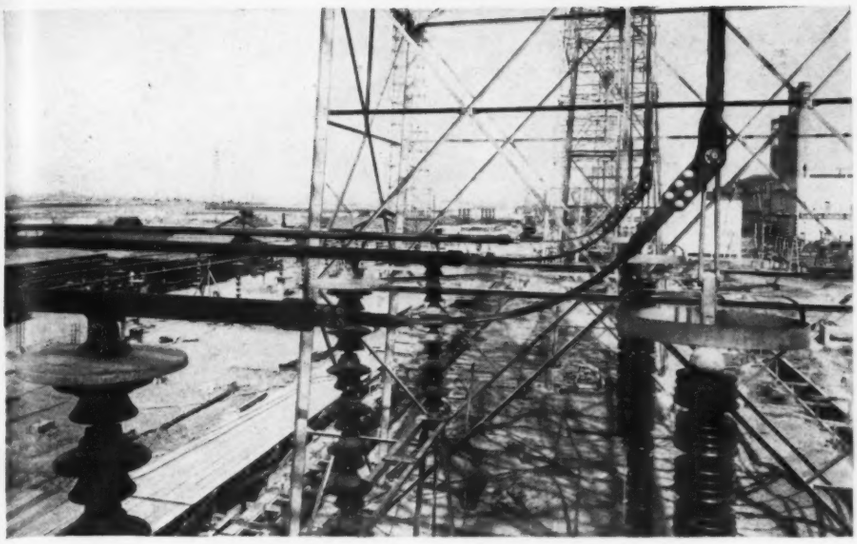
LONG-LIFE BATTERY RACKS.—Steel, while not acid-proof, can be protected through the use of acid-proof paint, something which cannot be done with wood construction. In this control battery installation at the Brunot Island station of the Duquesne Light Company the battery jars are supported on sheets of rubber matting.



Switching Unit Reduces Construction Costs

ON CONGESTED jobs savings may be realized, according to C. R. Beardsley, electrical construction engineer Brooklyn Edison Company, if certain parts of the work can be performed away from the point of congestion. For example, the high-tension switching and metering unit illustrated was shop-assembled and later installed in close quarters in a customer's vault.

On one job involving rush work four incoming 4,150-volt feeders and two metering cubicles, that is, six cubicles and four truck switches, were installed and placed in service in 51 hours of elapsed time.



Standard Jumpers Connect Risers with Bus

SPECIAL connectors and fittings were eliminated at the Long Beach steam plant of the Southern California Edison Company where the vertical 220-kv. conductors on high crossing towers join the horizontal bus by making connections with standard transmission jumper loop hardware as shown in the illustration at the left.

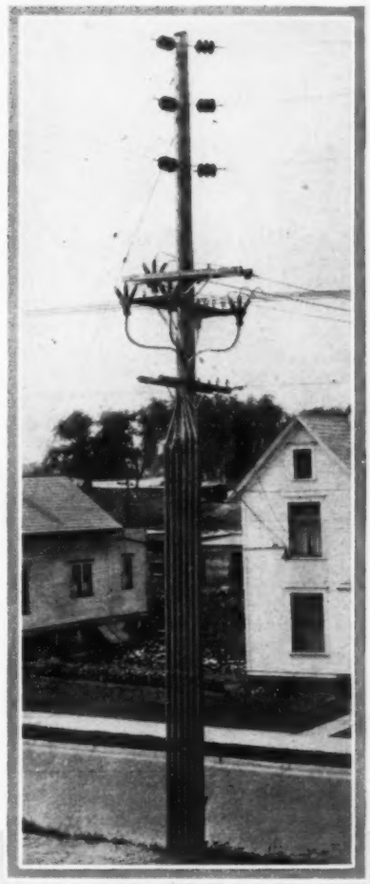
Advantages of Using Underground Terminals for Distribution Feeders

TO PROVIDE proper clearance on substation terminal poles it has become the practice of the Ohio Public Service Company to bring 2,400-volt distribution feeders out underground from substations. The accompanying illustration shows a 3,000-kva. substation serving a residential and business district load in Mansfield, Ohio. This station has four outgoing 2,400-volt feeders. Three conductor, 7,500-volt, lead-covered cable is used with disconnecting type pot heads on the pole and low tension structure. Unit type airbreak switches are used on the incoming 23-kv. line. Conduit-inclosed wiring from switch houses out to regulators has been used on regulated feeders to remove as much open wiring as is possible and to inclose high-voltage leads.

This type of construction has been found but little if any more costly than overhead construction and has the advantage of better appearance and provides much better and safer working conditions. It has also been found that the capacity of substations so designed can be increased or additional circuits installed more readily than with overhead construction.

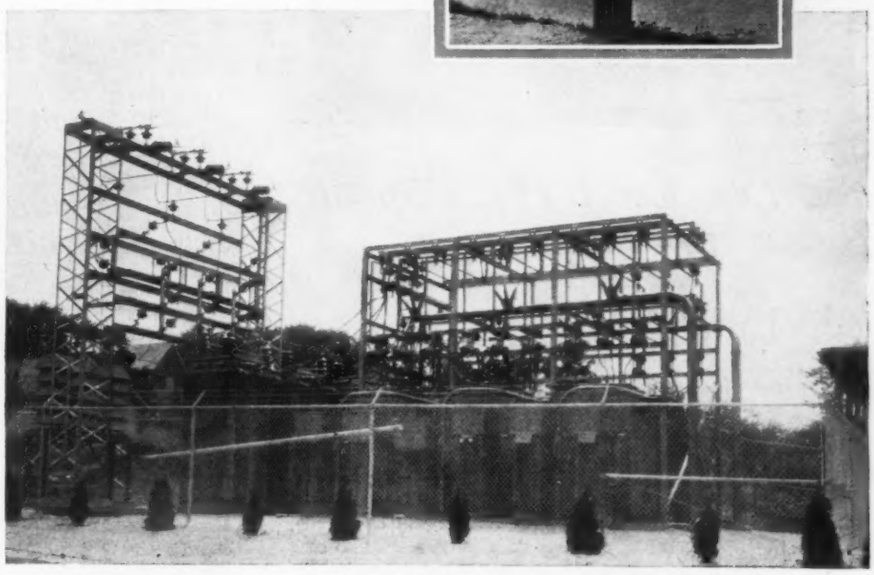
In this particular substation, located in a semi-residential district, particular attention was paid to grading and terracing the lot and sodding and seeding it. Fast growing evergreens were planted outside of the seven-foot cyclone fence and these within a few years will bush out, attain a height of 7 ft. and completely surround the station with a foliage fence.

This type of construction has been found more satisfactory and over a period of years more economical than overhead construction. In addition, while some residents of the section objected to the location of the substation when it was first started, since its completion the company has received a number of favorable comments on its appearance.



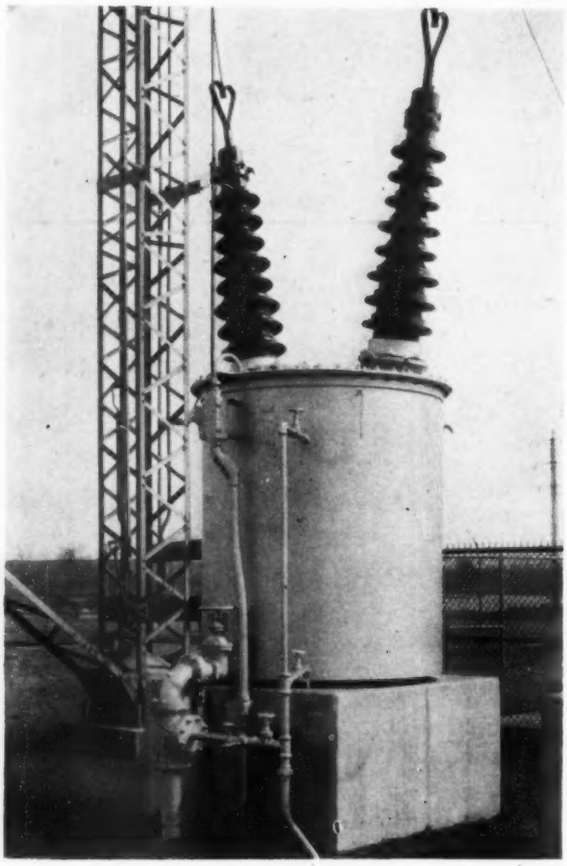
Terminal pole for 2,400-volt feeders brought out in conduit

All feeders brought out underground from this substation



Power Winch Pays Its Cost in 30 Days

ON THE street lighting pole erection job illustrated, two men and a truck driver performed the work of eight men in the field and eight more in the pole yards. Twice as many poles were set per day as with hand erection. Under these conditions the hoisting equipment paid for itself in a month or less. The Mead-Morrison Manufacturing Company equipped the truck with a 916-943 winch driven by power from the truck.

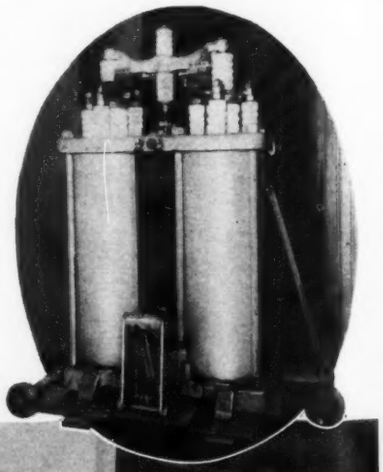


Compensating for a poor foundation

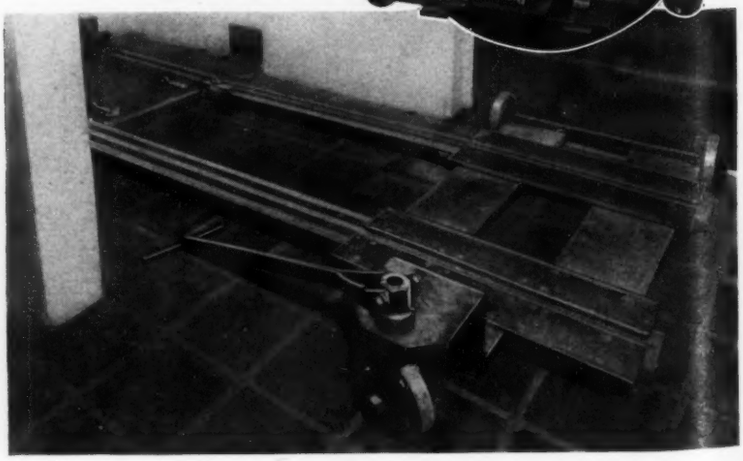
Annealed Loops Allow for Footing Settlement

By J. H. Wells

LOOPS of annealed copper 2 in. wide x $\frac{1}{8}$ in. thick, about 12 in. long and having radii of 6 in. were installed on all high-tension bushing connections at the West Springfield substation of the United Electric Light Company to permit terminal movement in case of foundation settlement. A vertical movement of about $2\frac{1}{2}$ in. is permitted by the construction shown. The conductors are clamped and sweated to Burndy terminals. The Stone & Webster Engineering Corporation, Boston, designed and built this installation.



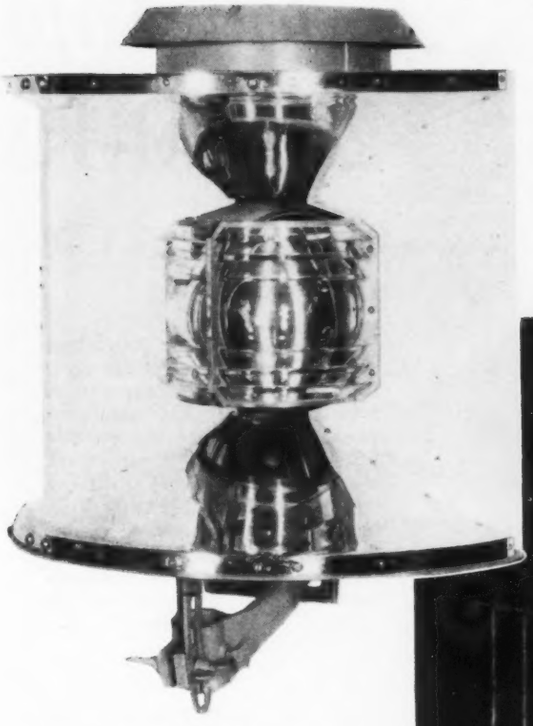
Time savings were realized by use of breaker-handling truck



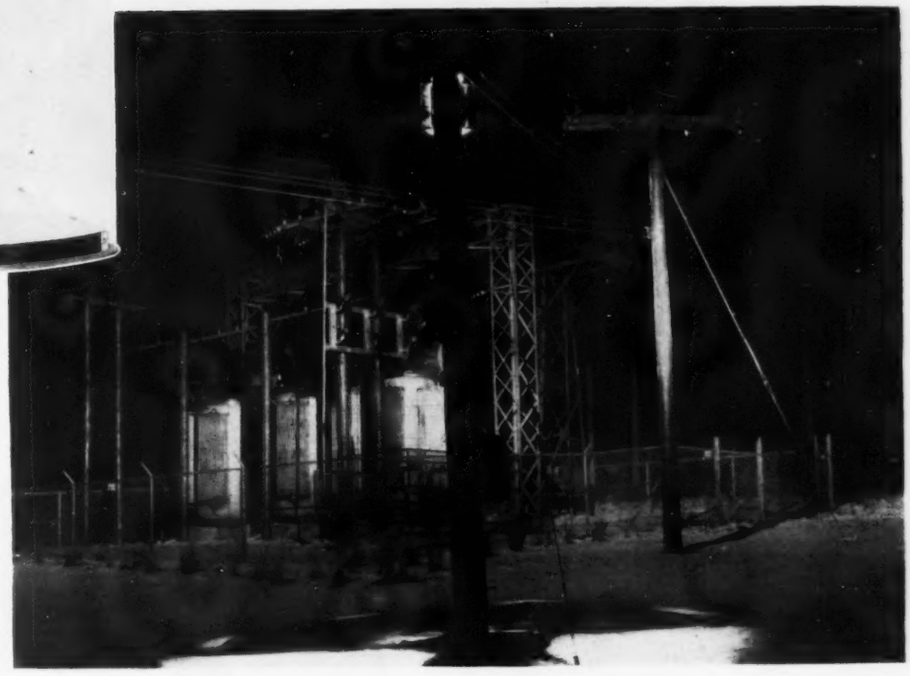
Low-Level Truck Speeds Placing of Breakers

INSTALLATION of oil circuit breakers in the Brunot Island station of the Duquesne Light Company was greatly simplified by the use of a low-level truck and grooved track runway. Breakers were loaded on the truck, taken directly to the point of installation and placed by means of the runway. The small over-all dimensions of the truck, the low-level characteristics and the relatively large directing wheel permitted handling in tight places and removed the limitation as to direction of travel, imposed by the unpivoted roller support of these breakers.

Outdoor Substation Lighted by Single Unit



THE outdoor switch yard of the tie-in substation of the Citizens Light & Power Company at Sage Run, Pa., is effectively illuminated in two planes by a single 1,000-watt, 110-volt floodlighting unit. The illumination is secured by the use of a type P.F.-8 triple-reflector floodlighting unit, supplied by the B.B.T. Corporation of America. The concentration upon switching apparatus, buses, transformers, etc., and the freedom from glare offered by this equipment are secured through the use of a hand-cut, ground lens giving a rectangular beam with minimum wattage and maximum efficiency.



Single floodlight effective in two planes

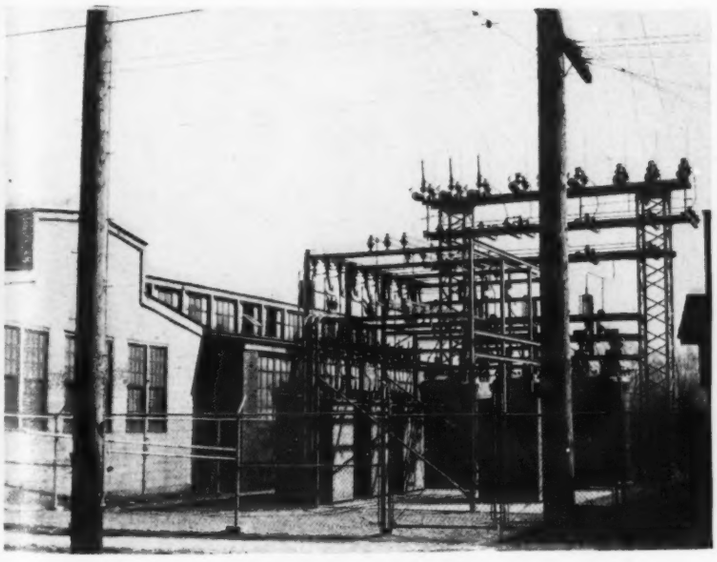
A pole-mounted unit floods switch yard effectively as indicated in unretouched view of station. Publicity values are also taken advantage of as the substation fronts on the Allegheny State Highway.

Switching Arrangement Eliminates Extra 23-Kv. Structure

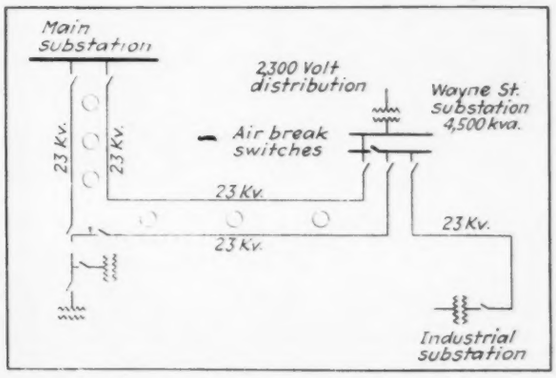
BY MAKING a few slight changes in its standard substation construction so as to mount three sets of 23-kv. air break switches instead of two for incoming circuits the Ohio Public Service Company solved a rather interesting switching problem and at the same time increased service reliability and saved considerable additional construction.

The accompanying illustration shows the company's Wayne Street substation at Mansfield and the diagram shows the arrangement of 23-kv. circuits from the main substation. Space in this location was at a premium. Accordingly the switch structure was lengthened, and a double bus with three sets of air break switches installed as shown in the diagram.

This arrangement put all switching operations on the company's property, saved street congestion and eliminated the need of a separate structure outside of the substation.

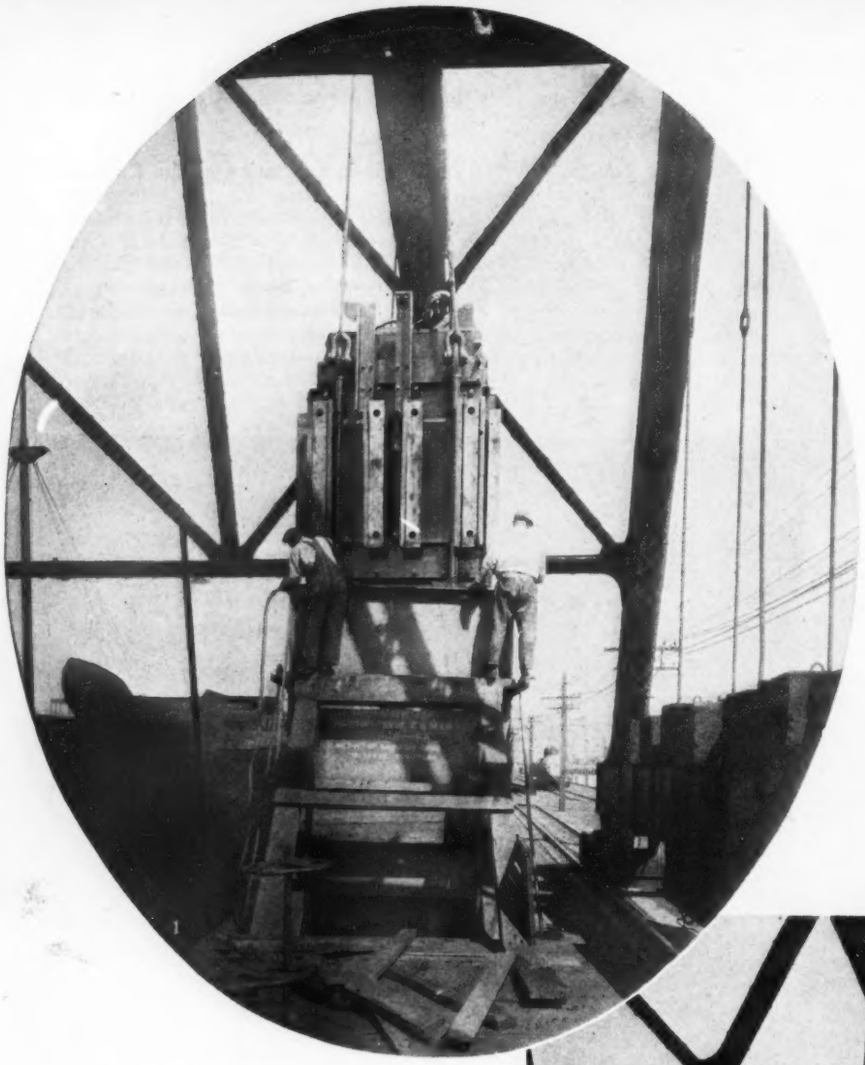


Substation changed to provide additional switching facilities



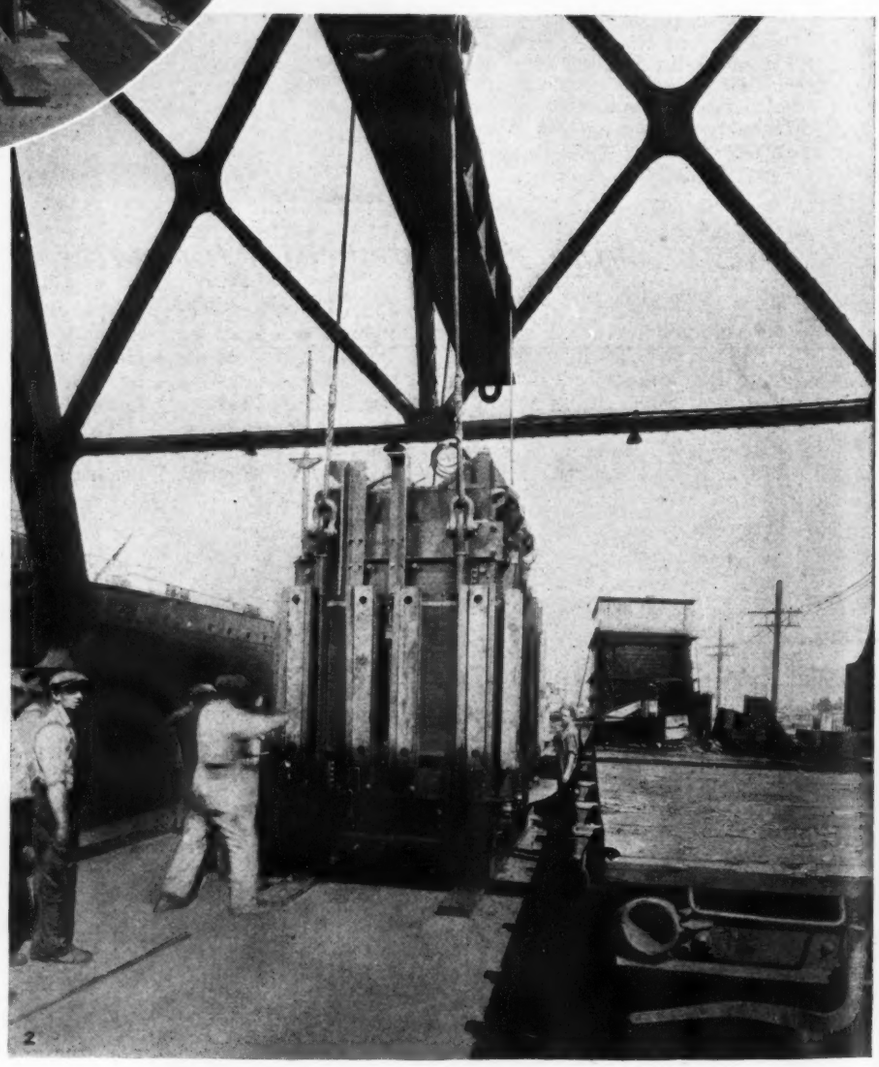
Arrangement of 23-kv. circuits and switches

Five Steps in 25,000-Kva.



Lifting core from shipping tank on railroad car at industrial plant on opposite side of river from station, using 175-ton crane.

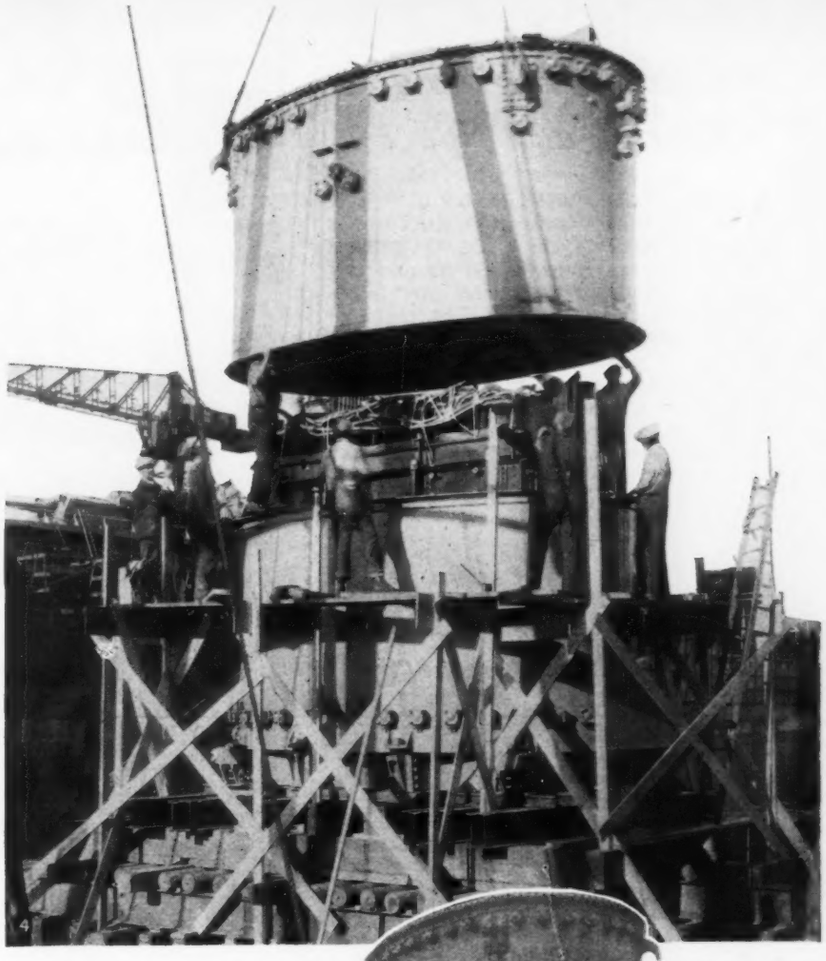
At flood tide the assembled unit was towed across the river to the wharf of the Edgar station. where a runway had been prepared to receive it. As the tide lowered the unit was slipped off the lighter and rolled upon the runway. About 125 tons was handled by horse-hauled windlass, twelve men handling the blocking. Two weeks were required to move the unit from the railhead to the permanent site.



Core on pier opposite Edgar station; wooden guard strips in place

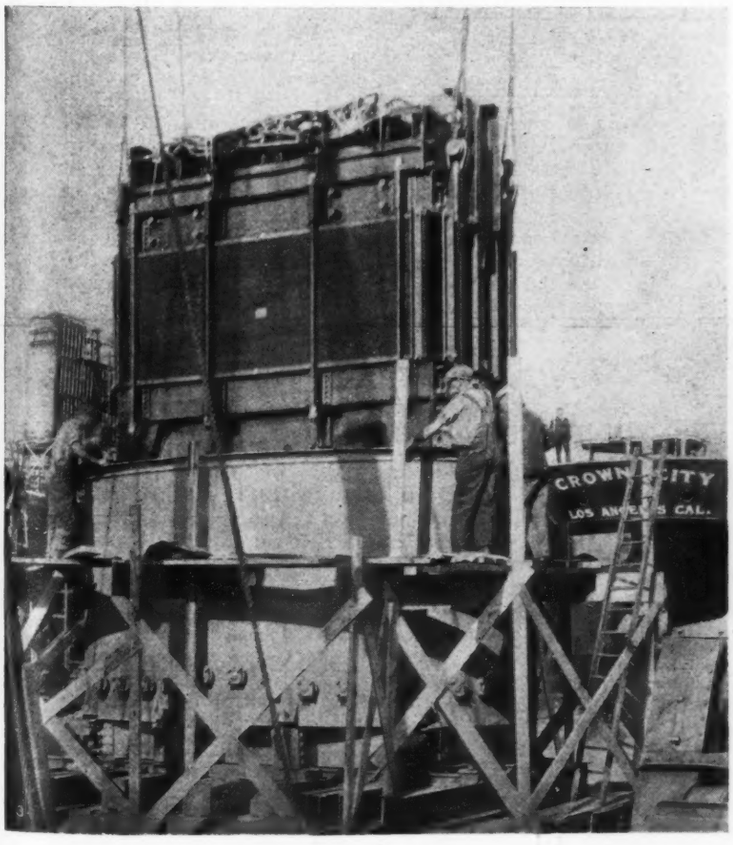
Handling Transformer

at Edgar Station



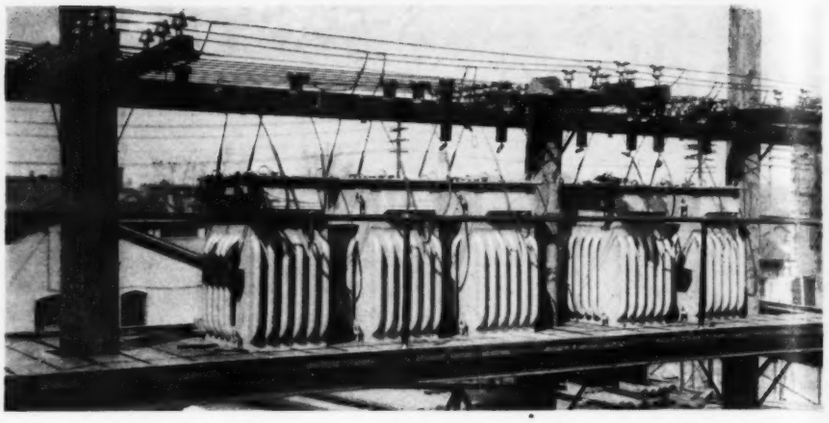
Lowering top section of casing over core

Swinging core into casing on lighter



Transformer being moved from lighter to wharf

Outdoor Transformer Saves Vault Space



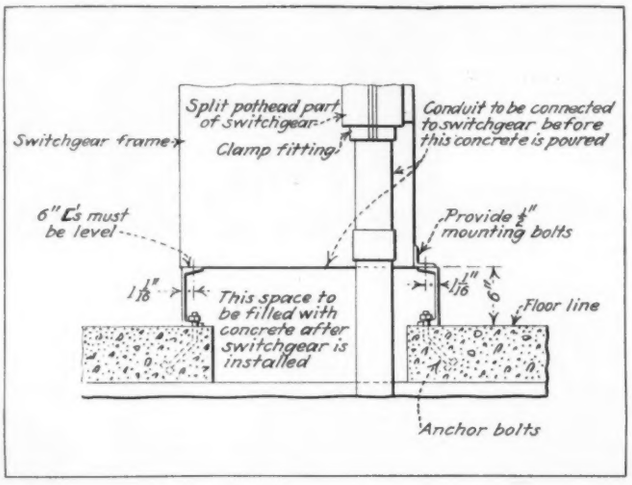
AN INCREASE in the number of "white-way" lighting standards in the business district of Mansfield, Ohio, recently, entailed the installation of additional transformer capacity. Formerly the white-way transformers were located in an underground vault in the business section, but this location did not permit of any increase in size without prohibitive expense. Accordingly an outdoor transformer installation involving five 30-kva. Westinghouse street lighting regulators was made and controlled from the Longview substation.

Method of Installing Armor-clad Switchgear

By F. J. Douglas

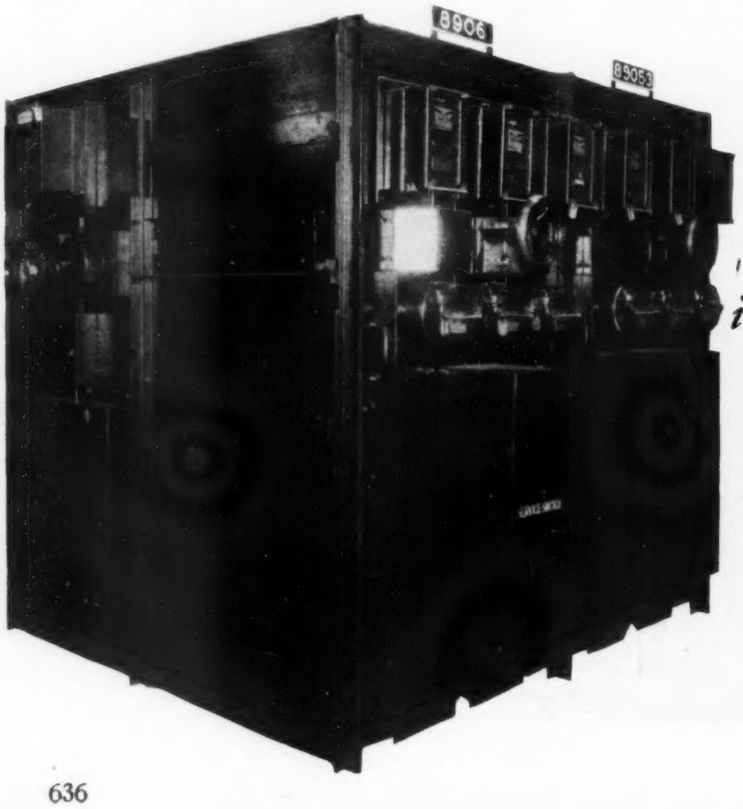
J. G. White Engineering Corporation

ARMOR-CLAD switchgear, which has recently become popular in some quarters of the country, offers some installation difficulties which will require further study. The structure has to be carefully leveled. A pothead, which is part of the switchgear, terminates within a very few inches from the bottom, and it is quite difficult to fit a conduit into it, after the conduit has been installed and is projecting up from a concrete slab, because it is very difficult to bring a conduit up exactly perpendicular. Flexible conduit has been used in some cases, but this, too, offers some difficulty, since large flexible conduit can only be bent at a rather large radius.


Split pothead part of switchgear
Conduit to be connected to switchgear before this concrete is poured
Switchgear frame
Clamp fitting
6" ℄'s must be level
Provide ½" mounting bolts
1 1/8"
This space to be filled with concrete after switchgear is installed
1 1/8"
Floor line
Anchor bolts

For installing the switchgear, it has been customary to finish the concrete slab, leaving small square holes at every place where anchor bolts are to be located. Then the switchgear is installed, leaving the anchor bolts attached but hanging loose in these square openings. After the switchgear is leveled about one teaspoon of grout is poured into the square openings in the floor slab. This is obviously a rather cumbersome and unreliable method, particularly when the structure rests on the ground floor.

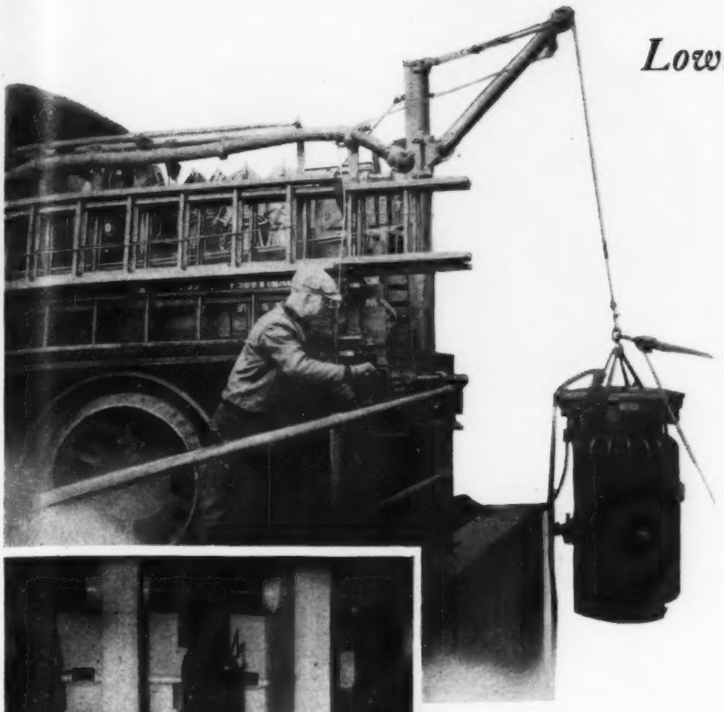
The accompanying illustration shows a simpler method which takes care of both the mounting as well as the conduit difficulty. A channel iron frame is provided, bolted to the floor slab and leveled as much as possible. The concrete within the frame is left out temporarily. The switchgear is bolted onto the channel, doing all necessary fine leveling by shimming on top of the channel frame. After the conduit is brought up and fitted exactly into the pothead, a coupling is attached, leaving a short piece of conduit between the floor line and the pothead. Finally the concrete is poured in the space within the channel frame and finished.



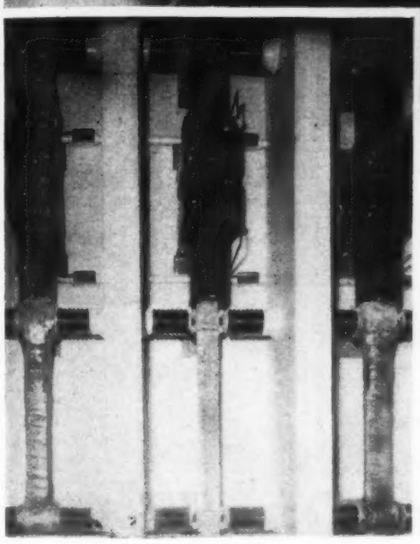
Truck Switches Avoid Delays in Serving Industrial Customers

IRON-CLAD truck-type switches with the necessary relays mounted on the front are used extensively by the United Electric Light & Power Company for serving primary customers. Besides being readily interchanged and less accessible to unauthorized persons, they have expedited provision of service. Cells do not have to be constructed for circuit breakers, instrument transformers, etc., panels do not have to be erected for relays and instruments and control and instrument wiring is eliminated in the field, as the service equipment is all mounted for installation and need only be rolled into the space reserved for it and connected to the incoming and customer's circuits.

Lowering Transformer Into Areaway

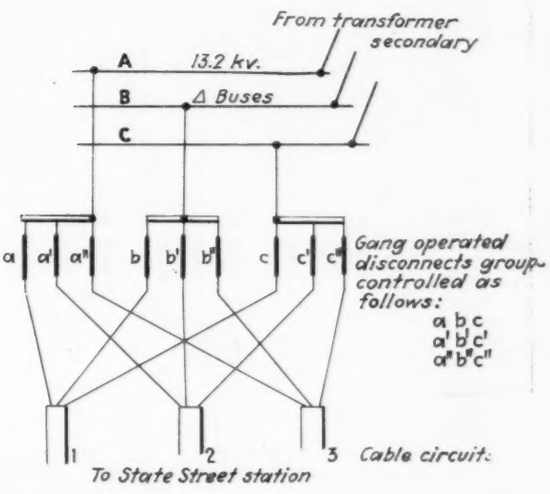


RAPID setting of transformers is achieved on the system of the Malden (Mass.) Electric Company by the use of a truck equipped with a crane and Mead-Morrison hoist. This type of crane enables the company to handle transformers for commercial and miscellaneous industrial service in situations involving unusual angles of descent, as shown in the accompanying illustration. The use of a block and tackle at the top of the transformer facilitates the spotting of the transformer with a pull-off rope and is most convenient when working under pressure to complete a job. The labor requirements are reduced to the simplest terms here.



Bus Sections Strengthened

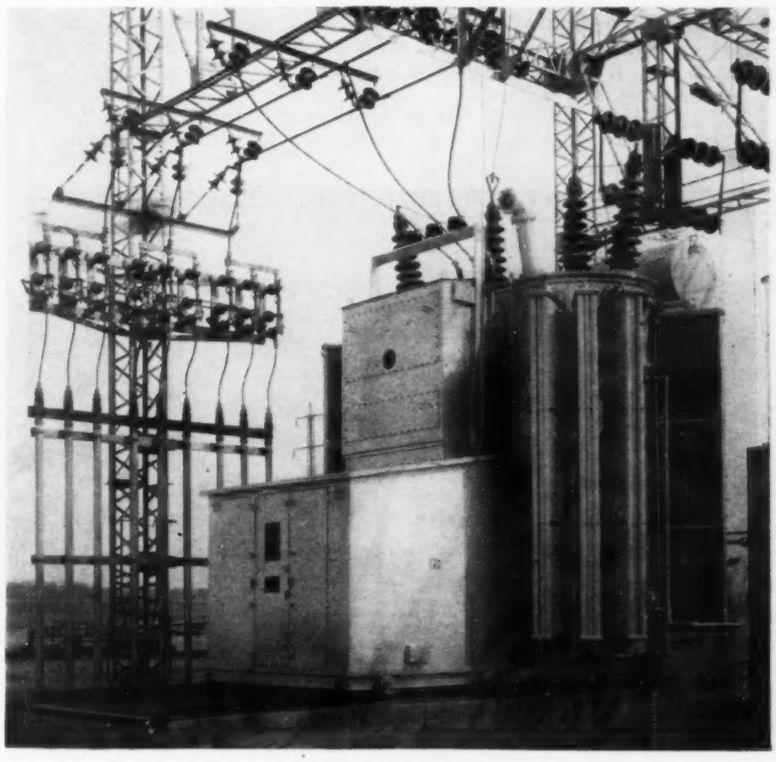
LONG bus sections in stations of the Duquesne Light Company are mechanically strengthened by mounting the insulators on precast lugs on the dividing walls. These lugs are produced by the use of sheet metal concrete molds. A strong, satisfactory job is thus attained through a bonded concrete-to-concrete joint.



Submarine cable isolated with minimum material and without delay

Secures Operating Flexibility in Compact Space

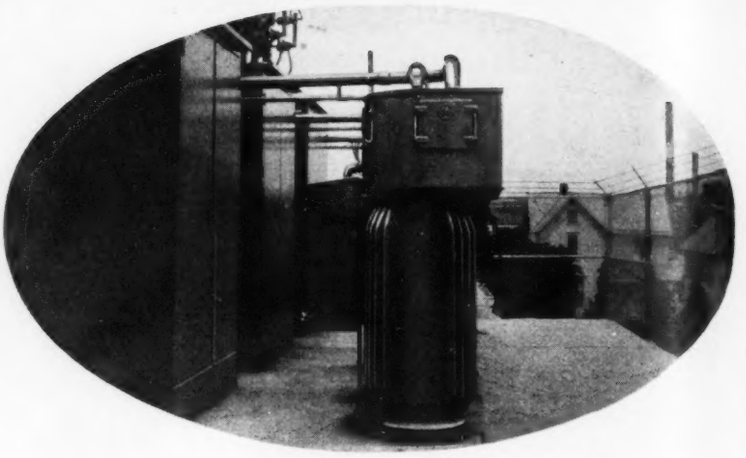
AT THE new West Springfield (Mass.) substation of the United Electric Light Company the power transformer units with tap-changing equipment can be rolled either separately or together upon a transfer track truck for quick inspection or repair work in a neighboring dismantling tower. Wiring and switches are designed for maximum accessibility. The transformer secondary leads (13.8 kv.) tap into buses supported by strain insulators attached to simple steel angles, the complex lateral members often found in such installations being omitted. To insure reliable service between the substation and the company's State Street steam plant on the opposite side of the Connecticut River, the crossing is made by three 3-conductor submarine cables, and each phase wire connects with the substation bus via a gang-operated disconnecting switch, the switches permitting any of the three cables to be cut out of service without interrupting operations on the others. The installation was designed by the Stone & Webster Engineering Corporation, Boston.

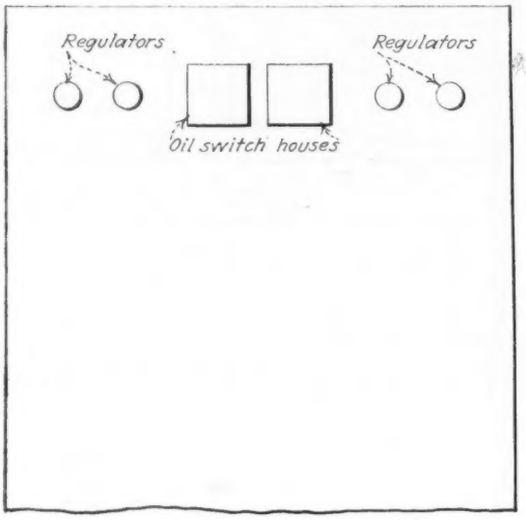


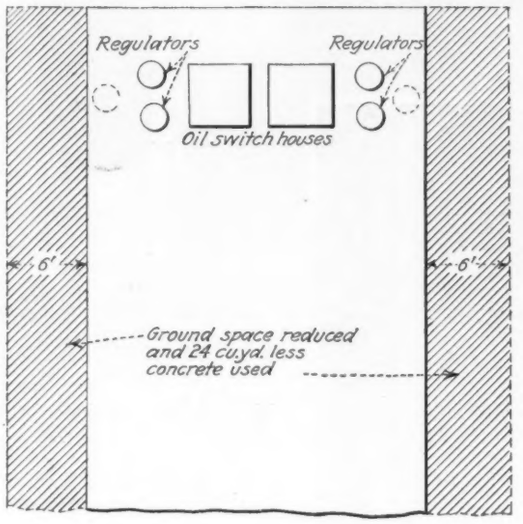
Economy in Substation Layout

CONSIDERABLE savings were made by rearranging the layout equipment for Ohio Public Service Company's substations. When more than one feeder regulator was installed on circuits leading from a single switch house the customary arrangement was as shown at the left in the accompanying diagram.

By placing the two regulators as shown on the right of the diagram there is still space for a third regulator to be installed should it be required. It was possible thus to save ground space 6 ft. in width on each side of the substation and it also made possible a saving of 24 cu.yd. of concrete, which would have cost approximately $200.







Voltage regulators were arranged to save space, ample provision being made for additional regulator

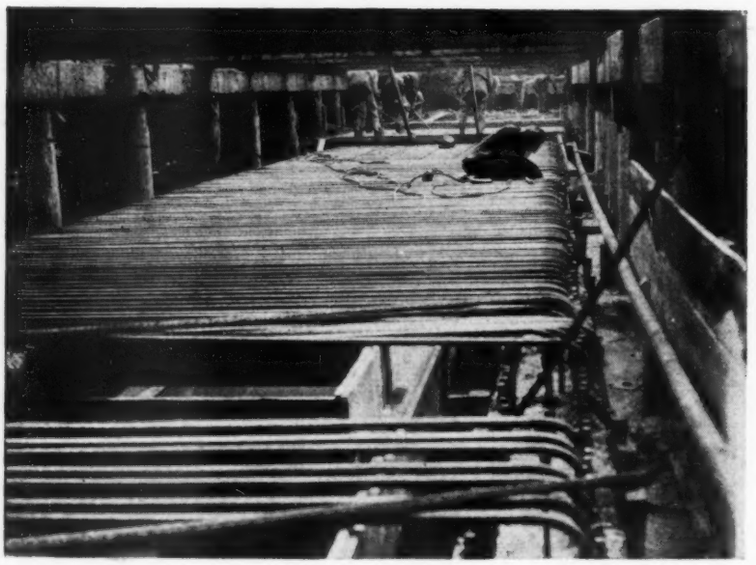
Welding of Reinforcing Bars Effects Large Saving

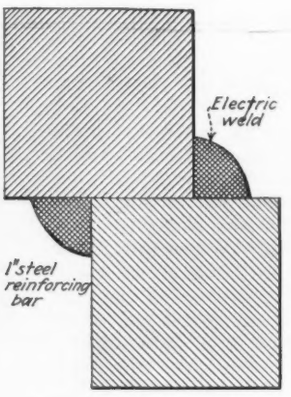
SEVERAL thousand dollars was saved by the Pacific Gas & Electric Company in the construction of a large concrete cooling water intake by electric welding of the reinforcing bars. The job was of special nature in that square concrete piling was used for the side walls of the structure and the roof was poured separately in place and joined to these side walls.

After the piling had been driven a foot of concrete was cut away from the top, leaving the steel reinforcing bars projecting by that amount. The roof bars were given a curved right angle bend at each end and placed as shown. The bars were overlapped 6 in. and welded.

The value of the pile was $5 per linear foot in place; the cost of cutting away was 50 cents per linear foot; the total cost of the electric welding was $900, a total cost by this method $2,495. There were 290 piles cut off and 1,500 linear feet of weld made.

The usual alternate method would have been to make the piles 4 ft. longer and to have cut away this additional 4 ft. of concrete in order to expose enough reinforcing bar for making the usual 40-diameter lap splice to the roof bars. This would have necessitated the loss of 1,160 linear feet of piling and the use of approximately 6 tons additional 1-in. reinforcing bar, making the total cost by this method about $6,780, or $4,285 greater than the cost of the method used.

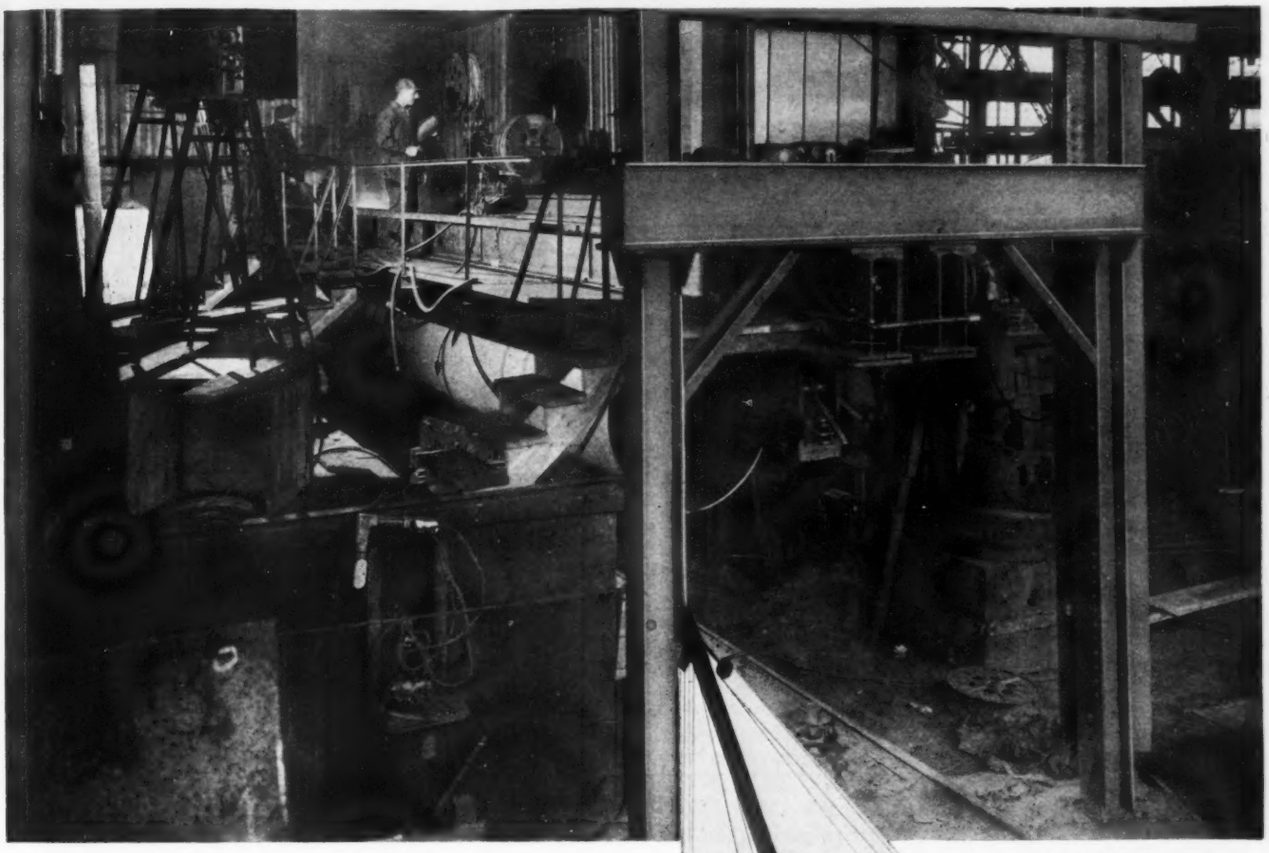




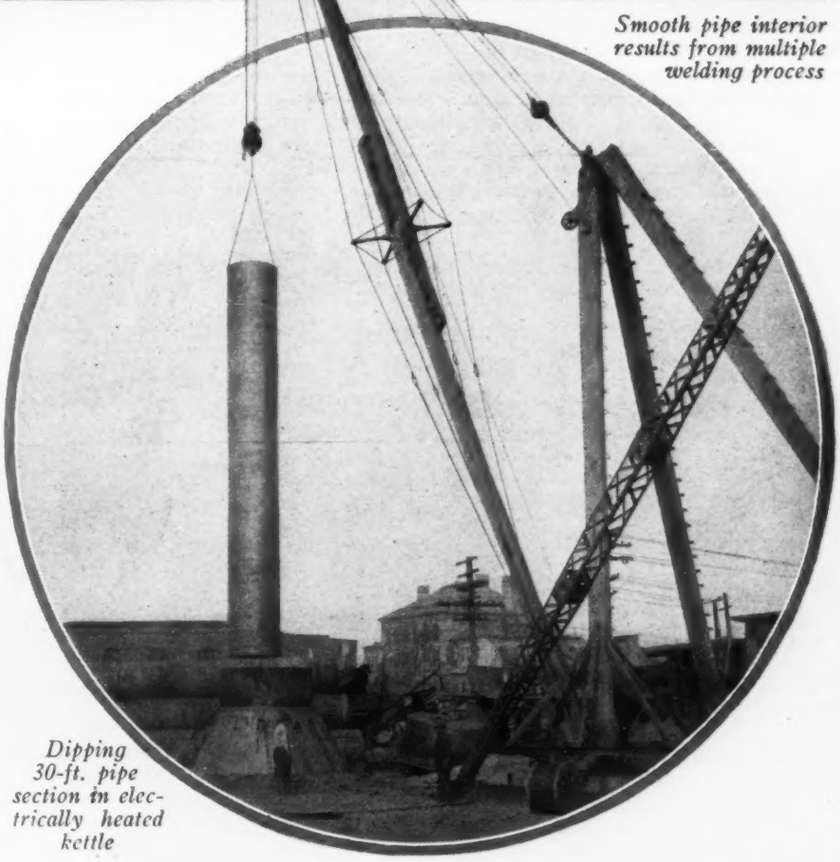
Cross-section of welded reinforcing bars

Electric Heat Aids Steel Pipe Manufacture

ELECTRIC welding and dipping processes play an important part in the construction of a 6.25-mile steel pipe line for the Springfield, Mass., water supply system now under construction. The pipe for this job aggregates about 4,500 tons in 48 and 54-in. diameters and in thickness from $\frac{7}{16}$ in. to $\frac{1}{2}$ in. It is made in 30-ft. sections from plates of firebox steel. Fabrication is being carried out at the shops of the Walsh Holyoke Steam Boiler Works, Inc. The flat plates on arrival at Holyoke are sheared and beveled and after crimping and rolling are assembled in a cradle and electrically tack-welded by hand on the inside to hold them in position for longitudinal seam welding, the tack welds being ground down smooth from the inside to present a uniform surface to the backing up bar of the multiple arc welder, which is of the General Electric automatic type, with a capacity of pipe up to 36 ft. length, 7 ft. in diameter and $\frac{5}{8}$ in. thickness. The welder is equipped with two traveling heads, each carrying a pair of metal wire electrodes mounted 8 in. apart, the welding speed being $4\frac{1}{2}$ in. per minute. When using 380 amp. on the first arc and 330 amp. on the second, the total consumption of $\frac{7}{16}$-in. electrode is from 0.8 to 0.85 lb. per foot of weld. The energy consumption is about 2.15 kw.-hr. per foot of weld on $\frac{1}{2}$-in. plate. After rivet holes are punched in each end of each pipe section it is cleaned and dipped vertically in an electrically heated tank of coal tar pitch varnish at about 315 deg. F. Each pipe receives two dippings, the kettle being 7.5 ft. in diameter and 40 ft. deep and equipped with eighteen 11-kw. heaters 34 ft. long.



Smooth pipe interior results from multiple welding process



Dipping 30-ft. pipe section in electrically heated kettle

Space Saving
with Oil-Immersed Synchronous Controllers

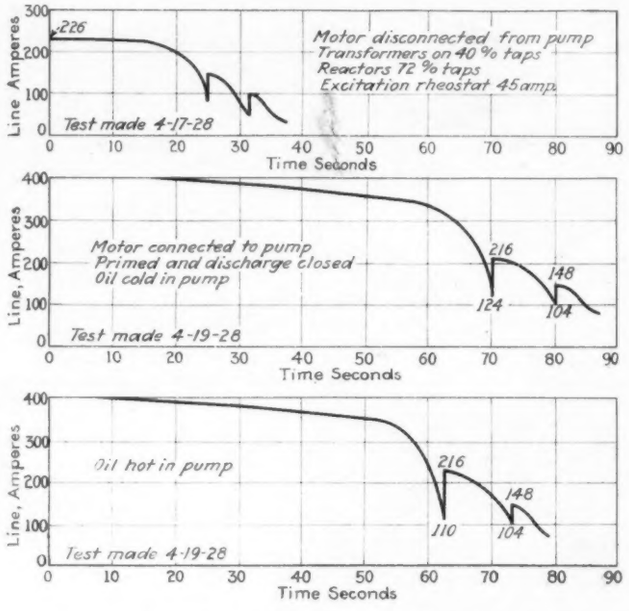
By H. K. HARDCASTLE
Philadelphia District Manager Electric Controller & Manufacturing Company

AN INTERESTING installation of a 500-hp., 2,200-volt, 3,600-r.p.m. synchronous motor, driving a centrifugal pump, delivering oil at 1,100 lb. pressure, was recently made by the Sun Oil Company, Marcus Hook, Pa., and illustrates the possibility of increasing production by the use of modern equipment, without requiring any material expense for enlarging existing buildings. The accompanying illustration shows this equipment complete as installed at one end of an existing pumping station, whose capacity was materially increased by raising the pressure from approximately 350 lb. to 1,100 lb. through installation of a high-speed synchronous motor operating a centrifugal pump.

A synchronous motor to run at 3,600 r.p.m. on 60 cycles must be a two-pole machine, similar in many respects to a turbo-generator. To prevent heating of the stator teeth, due to eddy currents, just as in a turbo-generator, the air-gap in the motor must be large. This large air-gap causes low impedance of the stator winding and makes the motor inherently sensitive to voltage fluctuations, which would cause objectionable high surges in the line.

Furthermore, since in the case of centrifugal pump applications the load on the pump increases approximately as the cube of the speed, it is necessary that the torque of the motor be rapidly increased with the speed until the motor is synchronized. In this application at the Sun Oil Company, this had to be accomplished efficiently under considerable variations of load and in the presence of explosive vapors.

Therefore, to keep down these line surges it was considered desirable to use a three-step, full automatic, instead of a two-step starter, and to cause the motor to develop a continuous and increasing torque during the entire starting period, without opening the circuit. How these requirements were met is shown on the curves reproduced here. To control the operation of the motor it is only necessary to move the handle of the master switch to the start position to start and to turn it to the stop position to stop the motor. When starting, the sequence of automatic electrical operations is as follows:



Starting current on 3,600-r.p.m. synchronous motor with three-step automatic starter

1. (a) The motor-driven exciter is started by a ZO switch and builds up direct-current voltage according to setting of the field rheostat.

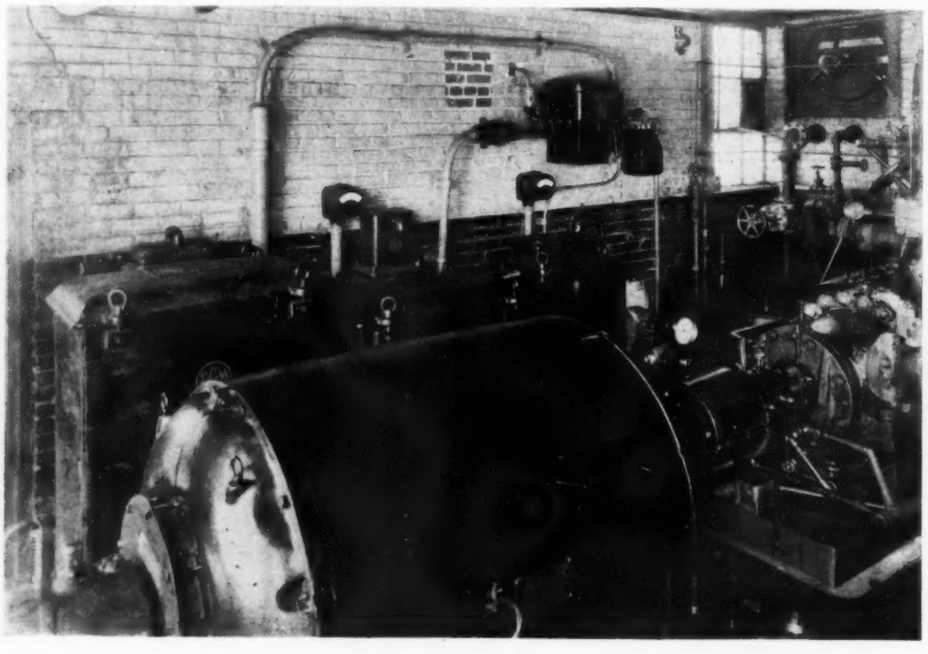
(b) The direct-current field of the synchronous motor is short circuited through an appropriate resistance to give greatest possible starting torque, and to prevent voltage strain on field winding by transformer action.

(c) Reduced voltage from a starting transformer is applied to the stator of the synchronous motor, causing it to start as an induction motor. Air for cooling the motor is brought from the outside through an air filter and underground ducts and discharged through an underground duct to the outside.

2. After the motor has come up to a predetermined speed a current-limit relay transfers the connections of the motor to a reactor without opening the circuit, thus increasing the starting voltage.

3. Next, after a predetermined time to allow the motor to accelerate to its maximum possible speed for synchronizing, the field is excited and then full voltage is applied to the stator, and the field short circuiting resistance cut out.

All the controlling apparatus is completely inclosed in sheet steel tanks and immersed in oil. This apparatus is also



Compact installation of three-step, automatic starter and 500-hp., 3,600-r.p.m. synchronous motor driving oil pump

arranged for conduit connections and is permanently grounded, so that it does not require mounting in a separate room, nor any special inclosure for the protection of the operators.

The power-factor correction of this unit is determined by the setting of the exciter rheostat to give unity power factor at normal load with a corresponding correction on reduced loads.

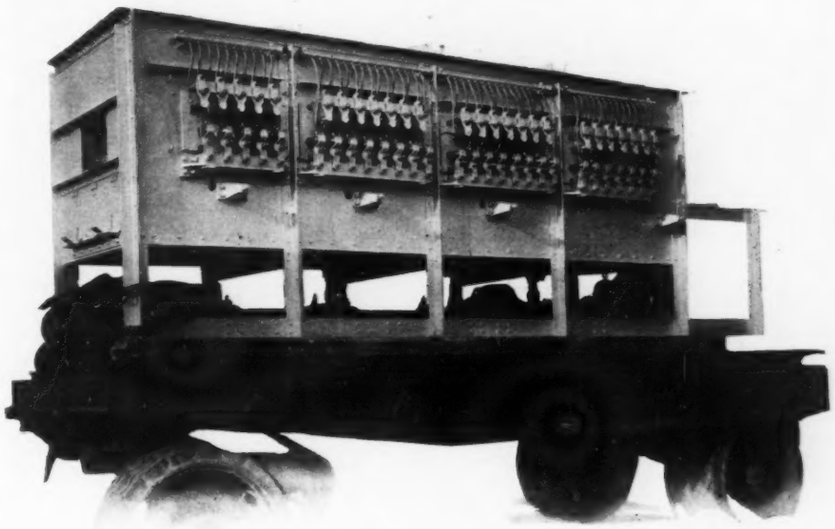
This apparatus, including the transformers, reactors, relays and contactors, was furnished completely assembled and wired, the installation was comparatively simple and it was only necessary to make the connections to the line and the motor, which was done by the Sun Oil Company's electrician.

Bending Conduit on a Boston Job

A CONVENIENT portable pipe bender used by the Hixon Electric Company, Boston, Mass., in wiring installation work consists of a clamping vise and appropriate dies fastened to a sheet steel base carried by four $\frac{7}{8}$-in. pipe legs. The legs are demountable by withdrawal from sockets in the base and the device can be set up or taken down in a few seconds.

Portable pipe bender for use on wiring jobs

Electric Forging Increases Production per Man-Hour



560-kw. walking beam type electric forging furnace has economy of 6 lb. per kilowatt-hour

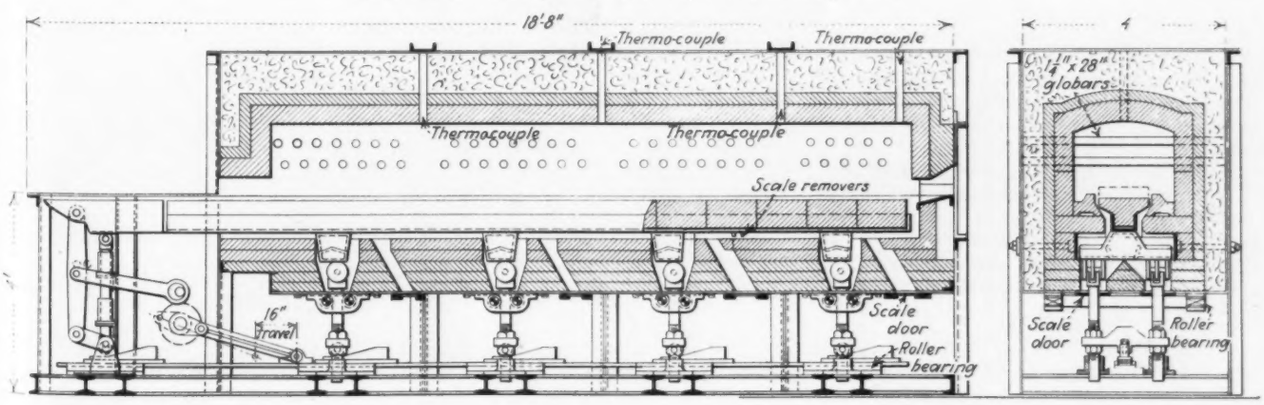
ONE of Detroit's largest automobile plants is finding that the use of electric furnaces has greatly increased production per man-hour in its forging department, largely because it is possible to run continuously without undue fatigue on the part of the workmen. Other advantages obtained are uniform grain structure of the forged parts due to uniformity of heating and the maintenance of constant final temperature.

The accompanying illustration shows a walking beam type of electric forging furnace which gives continuous production. This furnace, which was built by the Holcroft Company and equipped with Globar heating units, is of 560 kw. capacity and under normal operating conditions has an economy of 6 lb. of forged material per kilowatt-hour.

In the operation of the furnace the stock to be forged is cut to the desired lengths and loaded on the platform at the right of the furnace, from where it is conveyed through the furnace by a beam which moves upward and forward. The beam is actuated by an electric motor so that movement is continuous and uniform. The furnace is divided into two zones of control to insure uniform heating and temperature conditions by means of thermocouples.

The furnace shown here is the second electric forging furnace of this type to be installed by this automobile plant and a third furnace is now under construction.

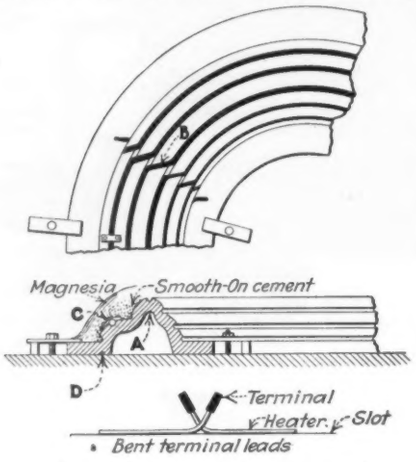
Diagram of walking beam type electric forging furnace



Method of Constructing an Electric Heater for an Irregular Surface

By H. A. Hands

IN INDUSTRIAL practice it is sometimes found necessary to heat annular surfaces of irregular cross-sectional shape, as in molding fancy-shaped rings. Under certain conditions it is deemed advisable not to use a greater mass of metal in the mold than is absolutely required. If both sides of the mold can be made flat and parallel, the mold can be easily heated in a press, but oftentimes this would mean a very great mass of otherwise unnecessary metal. This may be undesirable, not only because of the weight and expense, but because of the different thicknesses of metal through which the heat must travel to reach the material being molded, with consequent differences in temperature at different points. To overcome this difficulty the writer utilized a system of heating which is described.



Plan and cross-section of mold

The accompanying illustration shows a cross-section of a mold of such contour that it was found impossible or undesirable to use most of the standard types of electric heaters available. It should be stated here that in view of the sharp projection at *A* a mold of uniform thickness having flat parallel sides was found very undesirable because of the great thickness of metal which would exist at the other points. Other imposed conditions made it impossible to heat this mold in a furnace or oven, nor could the flat underside be heated. Therefore the following method was used:

The mold was cast with a uniform thickness of metal over the finished mold surface. This gave an exterior contour of the same shape as the interior. Into this outer surface were machined several circular grooves of proper shape and size, and spaced from each other in such a way that heaters imbedded in these grooves would furnish approximately the same amount of heat to each square inch of the active mold surface. At a certain point circumferentially around these grooves were cut "cross-over" slots, similar to cross-overs or switches in railway tracks, as at *B*.

Heaters in the form of rods, such as the General Electric "Helicoil" or Cutler-Hammer tubulars, were placed in these grooves, crossed over from one groove to the next, so as completely to fill the entire space prepared for them. By bending the terminals upward and to a slight degree outward it was possible to leave practically no space void of heating surface. The heaters could then be clamped in, as shown at *C*, in such a manner that expansion and contraction was possible without forcing the heaters out of the grooves. Connections between heaters could be made as desired, a previous calculation of the number, length and wattage of heaters having been made to assure that the proper connection of heaters would be possible to give the amount of heat required.

To assist in the uniform distribution of heat, the entire outer surface, including the heaters, was covereed with a layer of "Smooth-On" cement to a thickness of about $\frac{1}{4}$ in. Care was taken to see that this metallic cement was kept clear of the heater terminals to avoid grounds and shorts. Terminal connections were made with an asbestos-covered wire. The entire outer side of the mold was then covered with about 2 in. of magnesia for heat insulation.

It will be found that this type of application of heaters will be quite satisfactory under the conditions mentioned. Certainly it is capable of heating certain types of equipment which would otherwise present serious obstacles.

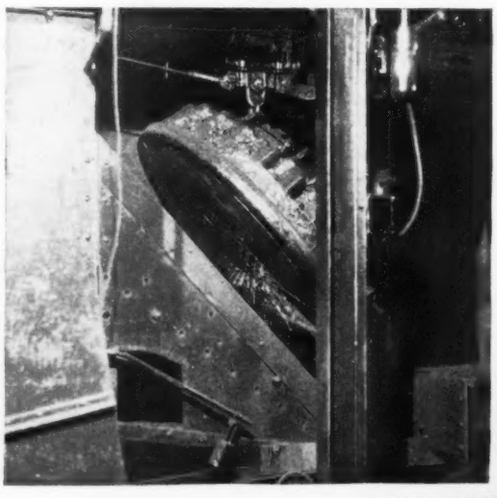
As an incidental suggestion, it might be added that a vapor tension bulb $\frac{1}{8}$ in. in diameter and of suitable length, placed in a circular groove as at *D*, and connected to a suitable instrument, can be used as a very satisfactory means of controlling the temperature of the article being treated.

One word of caution—in testing, with a lamp, heating equipment so constructed, care should be used that the current supply be direct-current and that the mold be electrically insulated from any supporting metal. The capacitance with alternating-current of such a construction is frequently sufficient to light the lamp even though the heaters be absolutely clear of ground.

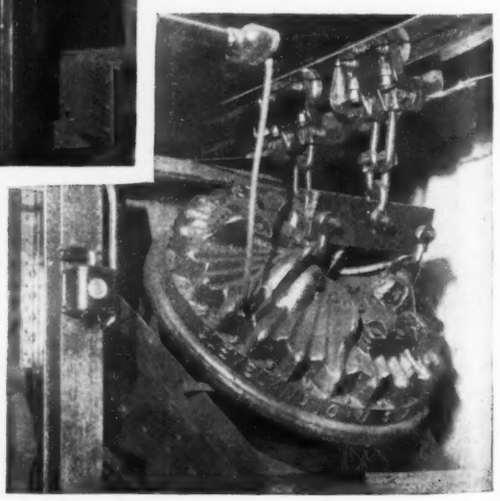
Coal Company Saves $500 a Month with Separator Magnet

USE of a separator magnet by a Pennsylvania coal company for removing material and tramp iron from coal as it is carried along a conveyor belt has made possible a saving of $500 per month through the salvaging of valuable material which can be put back in service plus the sale of the recovered scrap. In addition to these direct savings the removal of tramp iron from the coal prevents damage to coal crushers and pulverizers. A belt conveyor carries the coal from the mine to the loading dock so that all coal must pass under the magnet.

A 55-in. separator magnet built by the Electric Controller & Manufacturing Company is mounted at the head pulley of the conveyor where the coal drops from the belt. It is suspended from a double-truck trolley which rides on an I-beam, so, by means of a hand winch, the magnet can



55-in. magnetic separator installed over coal conveyor



Face of separator showing material collected

be quickly pulled out of position to drop the tramp iron that has collected and then run back into place.

The use of the magnetic separators is particularly advantageous to the coal company especially as nearly all of its customers now demand that the coal be free of tramp iron to prevent damage to their coal preparation equipment.

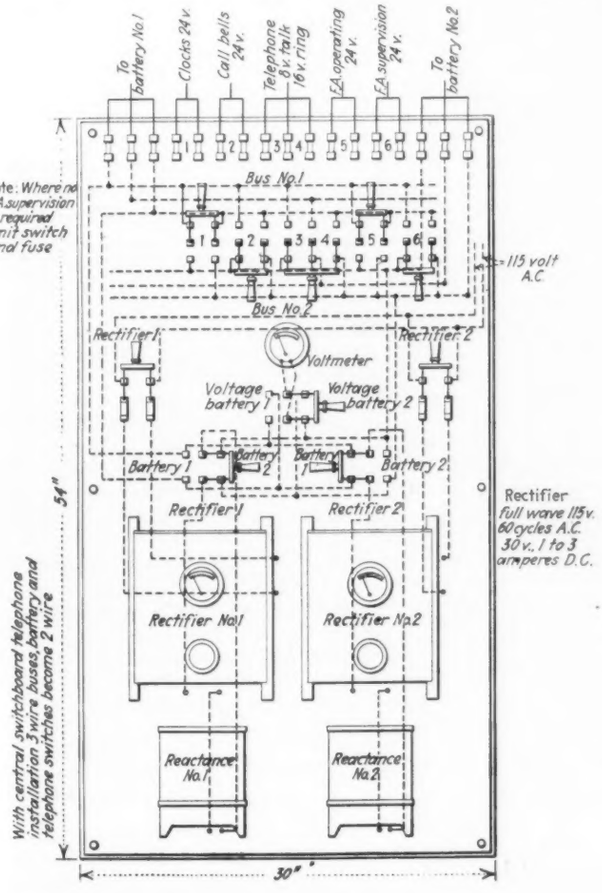
Combination Panel Serves Signal Circuits

By Edward B. Richardson*

TO FACILITATE the control of low-tension wiring services in school buildings and industrial plants the panel shown herewith has been designed and applied extensively in the practice of this house. In many installations the manufacturers' control panels designed for a single type of service only have been adopted by the equipment buyer and placed at points separated from one another and apart from the source of low-voltage supply. These standard panels associated with different services are useful, but we have found it more convenient to concentrate the low-tension systems control on a specially designed board as shown.

The panel is served by an incoming 115-volt, single-phase circuit leading to either of two rectifiers for charging either of a pair of batteries to supply the low-tension wiring at the required direct current voltage. Two sets of three-wire direct-current buses are provided, and the various circuits are so installed that any circuit can be run off either bus, that either battery can be charged by either rectifier. The first cost of the panel may exceed the cost of using scattered panels, but the operating convenience is greater, by far, and the time required to wire the systems to their controls and to effect a disseminated control equivalent to that afforded by the panel is probably 50 per cent greater where the panel is not used.

Partner, Richardson & Gay, consulting engineers, 220 Devonshire St., Boston, Mass.

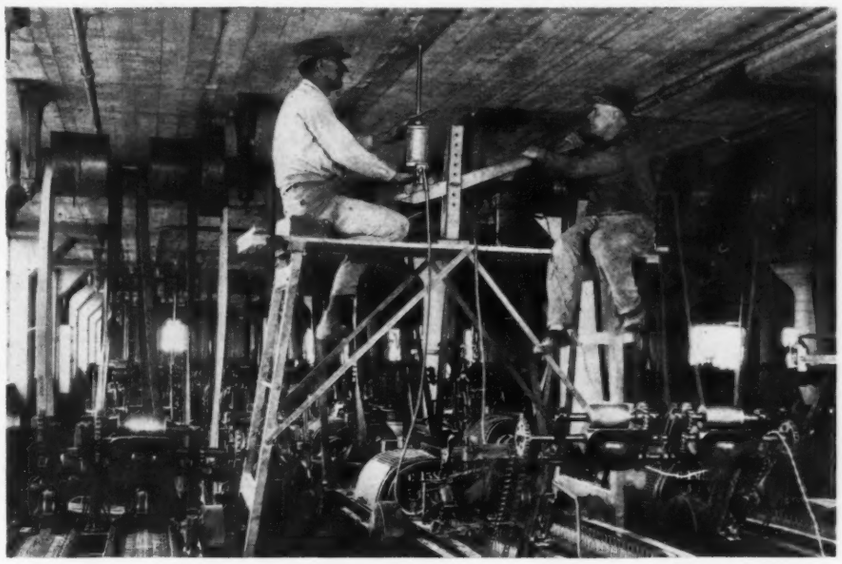


Compact panel for low-tension services

Panel 1¼-in. Monson slate. All switches, fuses, meter back connected. Leads to rectifiers and reactances from rear through holes countersunk at both ends. Mount panel on angle iron supports and provide all required braces to adjacent wall and floor. Buses and connections to be ⅛x⅜ in. copper, least size. All switches and fuses to be labeled with etched brass plates.

Electric Hammer Quickly Pays for Self

By J. F. Morgan
Hamilton, Ontario



A ONE-INCH electric hammer has paid for itself several times in our plant by increasing production and cutting down the expense for labor. It has been found particularly valuable in constructing and maintaining reinforced concrete buildings. Quicker and better work is accomplished because all holes are drilled full depth and are of ample diameter. When hand drilling is employed a number of holes are frequently skimped in depth. As a result the anchors have to be cut short and they eventually loosen after several months of building vibration. Furthermore, heavier individual blows are often struck with the hand hammer, spoiling the "clearance" edges of the star drill. With an electric hammer men take more interest in their work, and are less likely to become dissatisfied after continuous drilling, than with hand methods.

Checks made on the time used in drilling holes by hand and with a "Syntron" electric hammer in our plant have shown that on an average an electric hammer saves ten minutes in drilling ⅜-in. x 1-in. holes in ceilings and about 25 minutes when drilling ⅝-in. x 2-in. holes. These are the most commonly used sizes.

Some time ago it became necessary to change the equipment of several departments around. The changes included the installation of new lamps and motors and the relocation of old lamps, motors, shafting, knitting machines and other equipment. Upon checking the number of holes which the electric hammer drilled it was found that the time in labor saved during the moving operations more than paid for the hammer.

The installation of 60 Cooper-Hewitt lamps required that 120 holes, ⅝ in. x 2 in., be drilled in the ceiling for the suspension of the lamps. At 25 minutes each the saving in time was 3,000 minutes. Fastening down 200 "Benson" machines required 400 holes ⅝ in. x 2 in.

at a saving of 10,000 minutes. Conduit installations required 2,500 holes ⅞ in. x 1 in. at a saving of ten minutes each, amounting to 25,000 minutes. Miscellaneous installations required 180 holes ⅞ in. x 2 in., saving 4,500 minutes.

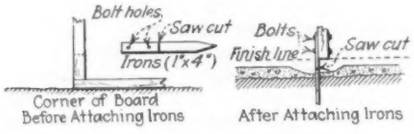
The total labor saved was therefore 708 hours' time, which at 50 cents per hour had a value of $354. From the foregoing figures it can be readily seen that it pays to use labor-saving devices in maintenance and construction work.

Temporary Wiring Solves Industrial Problem

By John S. Isdale
Meriden, Conn.

TO TAKE advantage of a sudden change in market conditions the electrical engineer of an industrial organization whose new factory was to be completed by a stated date was asked to cut his wiring installation schedule from one of about three months to one of three weeks. The buildings were of brick and steel construction, with floors ready to receive machinery when the change of schedule was ordered. As the number of men required to do a good job in conduit in three weeks was out of proportion to the advantage gained, if that number could be obtained, even in the metropolitan area, and as they could not work without being in each other's way, the only solution seemed "temporary construction." The management decided that the time gained would offset the cost of nearly double work.

Being summer, the lighting problem did not press. Effort was concentrated on the power supply and a temporary system was laid out and approved by the city inspectors on the company's assurance that safety of life and fire hazards would be provided for. As the voltage was 440, this was fairly easy, and a temporary outside substation was set up.



Method of supporting switchboard during floor construction

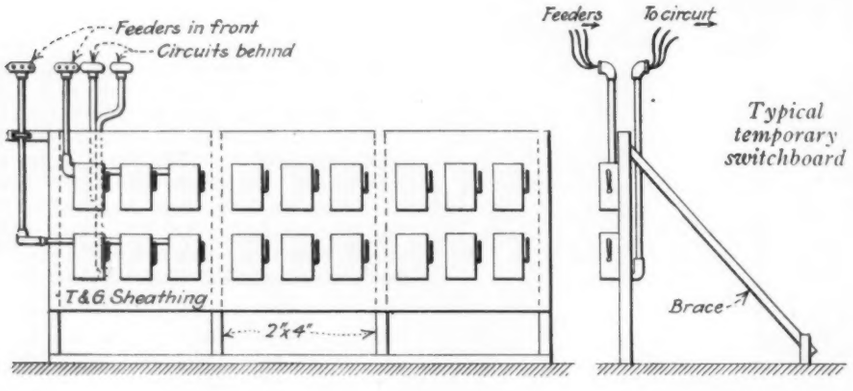
with a main switchboard in a building alongside the permanent substation, and distribution secured from that point, as shown in an accompanying illustration.

Cables were run on cleats and poles throughout yards and buildings to subdistribution boards of the same type as the main board, these boards being built of 2-in.x4-in. lumber, well braced, with tongue and grooved boards for switch mountings. From these points wiring was run on cleats to the machines, but compensators and disconnecting switches were permanently mounted, as also was the wiring from starters to motors.

When the machines went into production the permanent system was installed. The conduit was erected and permanent distribution cabinets set up. Cables were connected, and the construction force was reduced, the remaining men putting on the finishing touches and connecting the motors to the permanent system. Meanwhile, construction had been proceeding on the permanent substation, and as the circuits were transferred (usually in shutdown periods) the temporary system was dismantled.

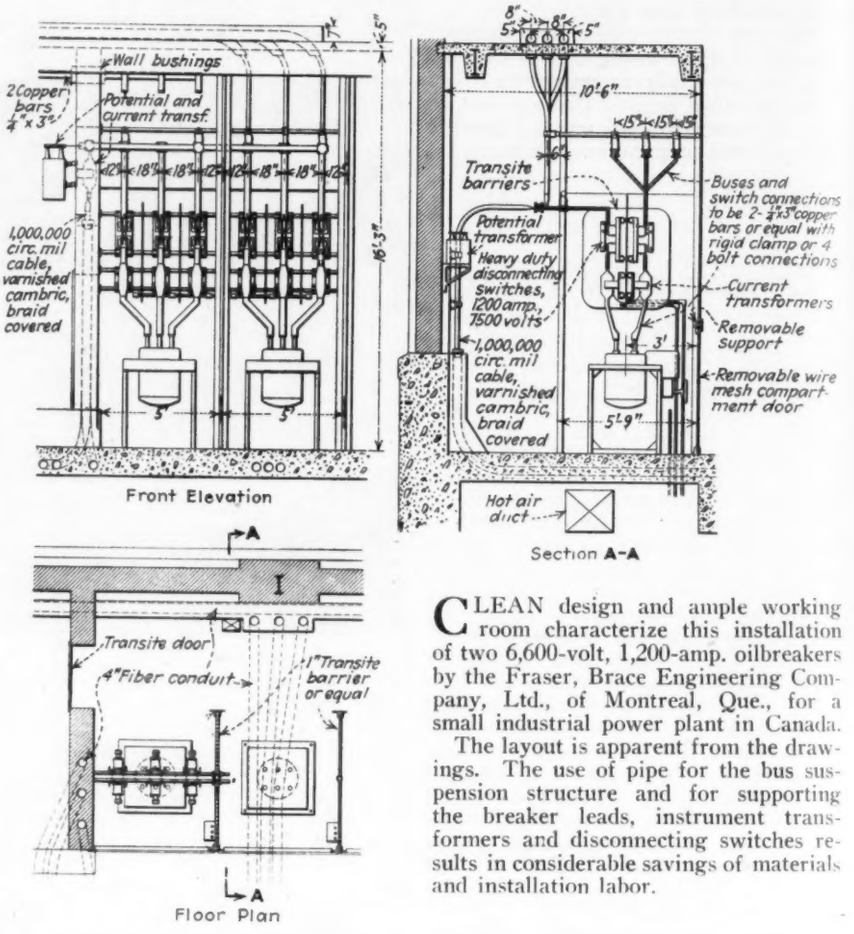
At one point the temporary main switchboard interferred with the laying of a concrete floor, as its supports rested on the ground. This was overcome as shown. The supports and stays were bolted to irons 1 in. x 4 in. driven into the earth. The wood was then cut away above the floor level and a cut made with a hacksaw across the flat of the iron, about ⅛ in. deep at the second layer of concrete. The floor was then laid, the first layer as usual, the second having holes left around the irons. After the board was taken down the irons were broken off with a sledge and the holes filled.

On a job like this necessity was indeed the mother of invention, and although many obstacles had to be overcome, the whole installation proceeded without hitch or accident and the company was enabled to ship its products and sell on a favorable market.



Typical temporary switchboard

Compact Switch Installation


Wall bushings
2 Copper bars 4"x3"
Potential and current transf.
1,000,000 circ. mil cable, varnished cambric, braid covered
Front Elevation
Transite barriers
Potential transformer
Heavy duty disconnecting switches, 1200 amp., 7500 volts
1,000,000 circ. mil cable, varnished cambric, braid covered
Buses and switch connections to be 2-¼"x3" copper bars or equal with rigid clamp or 4 bolt connections
Current transformers
Removable support
Removable wire mesh compartment door
Hot air duct
Section A-A
Transite door
4" Fiber conduit
1" Transite barrier or equal
Floor Plan

CLEAN design and ample working room characterize this installation of two 6,600-volt, 1,200-amp. oilbreakers by the Fraser, Brace Engineering Company, Ltd., of Montreal, Que., for a small industrial power plant in Canada.

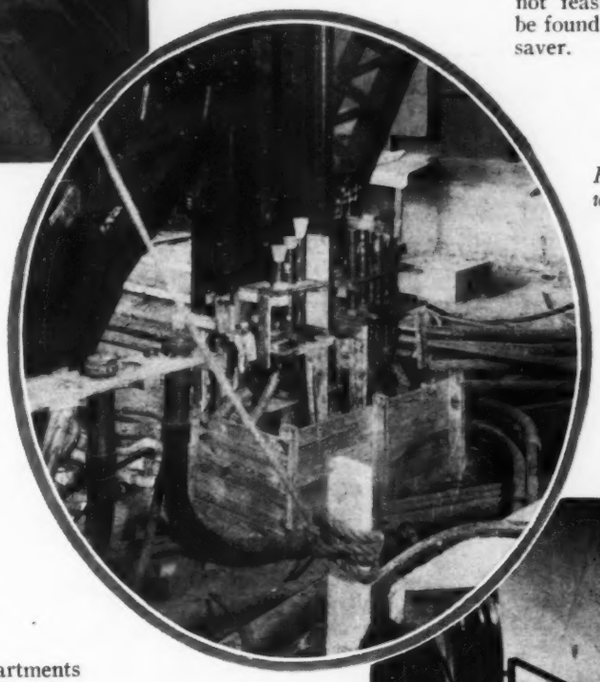
The layout is apparent from the drawings. The use of pipe for the bus suspension structure and for supporting the breaker leads, instrument transformers and disconnecting switches results in considerable savings of materials and installation labor.

Reducing Cost of Conduit Runs

TO AVOID the expense of hand-formed conduit bends the electrical construction bureau of the Brooklyn Edison Company has used flexible metallic conduit. With this material shapes may be formed to suit conditions exactly, with either long or short radii. The flexible duct may, according to C. R. Beardsley, electrical construction engineer for that utility, be literally kicked into position with negligible labor as compared to the expensive method of bending pipe to a template, with trial fits, necessary handling, use of heavy pipe benders, cutting tools, etc.

To join flexible duct to rigid pipe straight standard connectors are utilized. To anchor conduit in place a light bed of cement grout is used and a thin, fairly dry covering smeared over the duct. This seals any gaps at the bends and prevents seepage into the conduit when the heavy floor fill is later poured with a consequent pressure head and with a wetter mix. Mr. Beardsley points out that the design should be carefully prepared so as to use the economical straight runs whenever possible, but where this is not feasible the above method may be found useful and an effective labor saver.

Grouted cover protects flexible conduit from seepage during pouring of floor



Flexible conduit used in congested areas

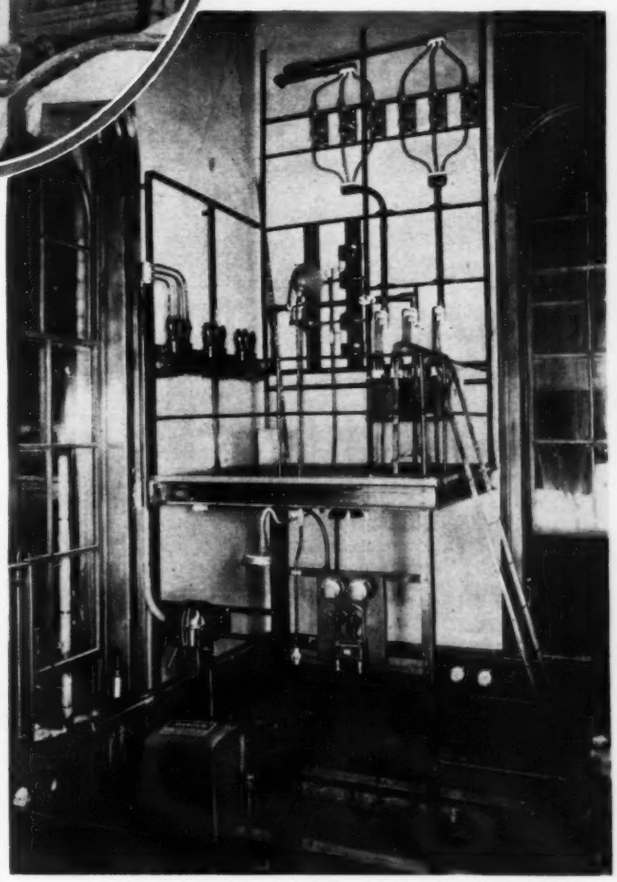
Electrification Saves Building Expense

MUNICIPAL water departments are finding that electrification of their pumping plants not only reduces the cost of operation as compared with steam-driven plants, but also that electrically driven pumps and control apparatus can be installed very economically in existing pumping stations without entailing much additional expense for new buildings. The accompanying illustration shows the wiring and control for a 200-hp., 2,200-volt motor driving a 5,000,000-gal. centrifugal pump recently installed in the city water station at Sandusky, Ohio.

Two independent three-phase, 2,300-volt circuits were brought into the building through cutouts as shown at the top of the view. Each circuit is brought in conduit to an oil switch equipped with an overload release. Both oil switches are connected on lines running to the auto starter shown at the lower left. The oil switches are interlocked so that only one can be closed at the same time. Two extra outlets have been provided on the conduit run for future additions.

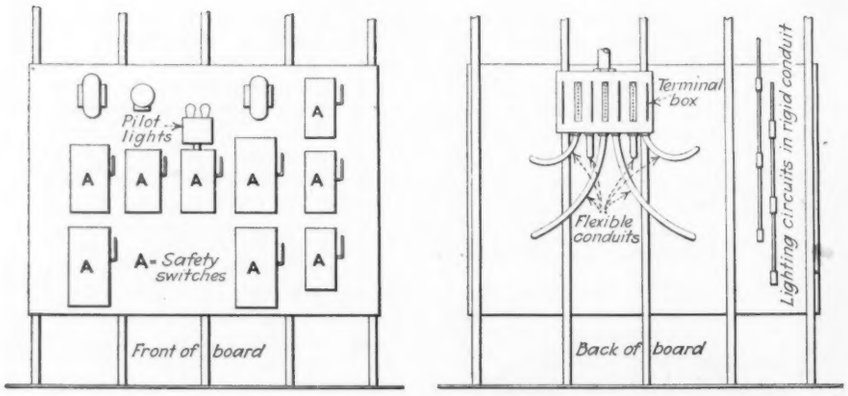
Pump and motor occupy a small space in the basement under the opening in the floor. The complete installation of wiring, pump and motor occupies only the space shown in the illustration, which was virtually waste space in the steam-operated station. The only cost for building alteration was the laying of a concrete foundation for the motor and pump.

Wiring and control for 200-hp. electrically operated centrifugal water pump



Low-Cost Wiring Layout Affording Flexibility

By Clarence W. Kinney
Consulting Engineer, Worcester, Mass.

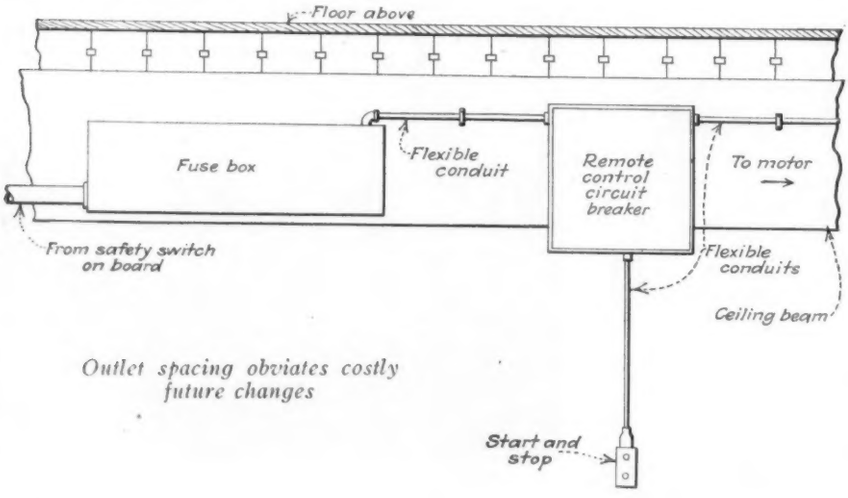


Terminal box and safety switches on wooden switchboard

IN A Massachusetts industrial plant utilizing about 40 motors, ranging in rating from ½ hp. to 10 hp., it was necessary to keep down the cost of the wiring installation and do away with obstructive locations of circuits and control apparatus. All control equipment had to be kept off the posts and walls without sacrificing accessibility and convenience for machine operators. A large percentage of the motors was installed for individual driving. The situation was met by the installation of a wood-frame switchboard with asphaltum treated members, the use of flexible armored conduit, safety-type switches and remote-control circuit breakers with pendent start and stop pushtons.

The incoming service (three-phase, 550 volts) was carried through a service switch, junction box and meter to the switchboard in conduit, the conductors terminating in a box mounted on the rear of the board with buses inside separated by insulating barriers. Each bus was provided with several wire lugs for tap circuits. From the terminal box buses the tap circuits for the various motors were run in flexible conduit to safety switches mounted on the front of the board, the taps from the buses being of sufficient size to permit use without fuses ahead of the sub-circuit switches. This method of mounting the safety switches, back-connected, made it possible to place the switches close together, facilitating disconnection from the busbars or the installation of additional switches without interrupting the service. Fuses and a remote-control switch for each of the motor circuits were installed on the ceiling beams. The control buttons were suspended at convenient points for operation and, by using care as to the type of connector employed and in applying connectors and clamps, flexible armored conduit could be used without trouble for pendent support of buttons. Both sides of the switchboard can be worked upon with ease, and there was a saving of about $150 in labor and material through elimination of a slate board and of about two days' work by an electrician and helper in the wiring construction.

In planning the sub-circuit wiring the location of all motors on the several floors of the factory was plotted on one plan, from which it was an easy matter to arrange the sub-mains and risers. These were extended, without change in size, to the most distant cutout. A junction box for future use was installed in the conduit runs of the sub-mains every three lengths of conduit. These boxes have been useful as changes have been made from the original plan and permit access to the circuits without making long runs or cutting into the conduit.



Outlet spacing obviates costly future changes

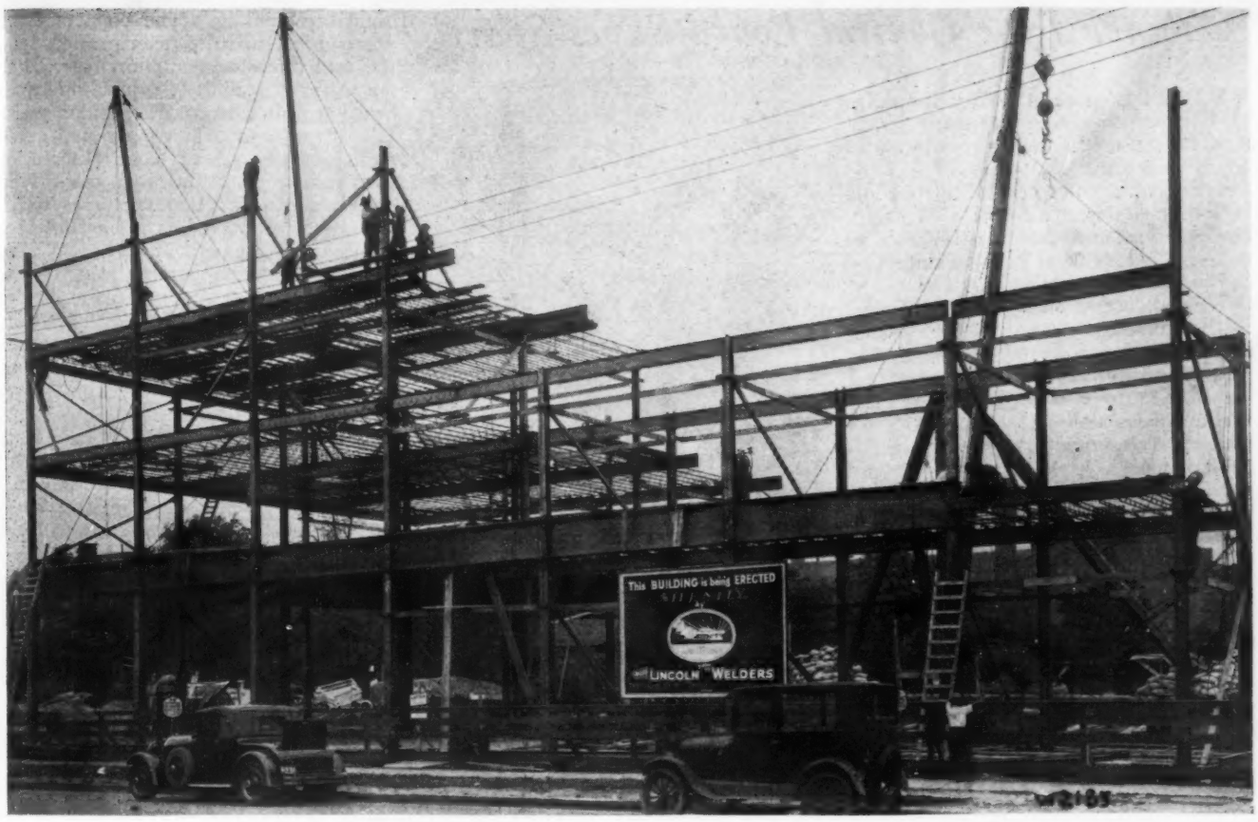
Labor and Material Saved in Arc-Welded Building

SAVINGS of 15 per cent in material and indication of similar reduction in labor costs are being effected by the Austin Company, architects and builders, through the use of electric arc welding in the fabrication and erection of the structural steel frame of a four-story commercial building now under construction in Cleveland, Ohio. In addition to these economies much favorable comment has been made by people living in the vicinity of the building operations on the quietness of the construction work due to the arc-welding process instead of the use of pneumatic riveting hammers usually heard on steel erection jobs.

By the use of the electric arc-welding process for making all connections on frame members all punching and riveting were eliminated in the shop fabrication of the structural members; field bolts and rivets were also eliminated from all connections made in the field. In planning the construction of this building the Austin Company employed all the known economic advantages of arc-welded steel construction in designing the steel structure.

The view of the partially completed framework shows how continuous beams are used instead of the usual multi-story columns. This design is most efficient and economical with arc-welded construction for this type of building as a substantial saving of material can be effected. Because of the length of the building continuous beams could not be obtained from the mill in one piece. Two pieces, making up one continuous beam, were butt welded in the center of the fourth bay from the left. The only splice members employed are short pieces of plate welded on the inside of the flanges of two sections of the beam. The ends of the two sections of the beam were butted and then welded. This type of connection makes the two sections one solid steel beam.

Another interesting feature is the design of the continuous beam construction at column connections where stiffeners are placed to carry the lines of the column through the beam. The connecting angles and stiffeners were welded in place on the beam section at



Partially completed arc-welded steel structure

the fabricating mill. The column is fillet welded to its base plate only along the outside sides of the column flanges, no angles being required to make the connection, as is required in riveted construction.

All welding of the structural steel both in the fabricating shop and in the field was done by the Lincoln Electric Company. A battery of six "Stable-Arc" welders were used to supply welding current to the six operators employed in fabricating the steel. Five machines made up the battery required for the five welding operators employed in making the field connections.

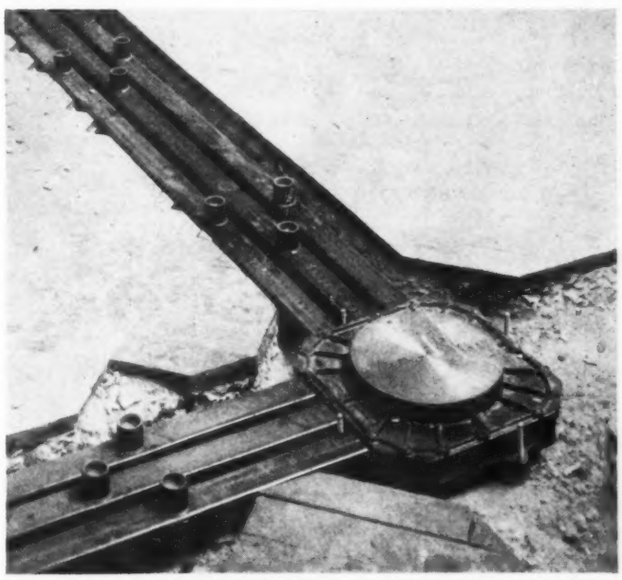
The total savings effected by arc welding instead of riveting the steel structure of this building cannot be computed until the building is completed. It is estimated that a saving of 15 per cent in material will be effected and labor costs at this date indicate substantial reductions.

Uniformly Spaced Outlets Avoid Floor Reconstruction

AN INSTALLATION of a special rectangular cross-section duct system with unit outlets in the banking room of the New England Trust Company, Boston, was recently made to avoid future serious disturbance of the flooring in the event of changes in office layouts and desk locations. In this case 570 ft. of Walker floor duct was provided, with 285 outlets and seven cross-over boxes, the duct sections being $1\frac{7}{8}$ in. x $1\frac{1}{4}$ in.

The outlets are spaced 24 in. apart and are provided with knockouts, facilitating the future provision of risers and pulling in of wiring as circumstances demand. Three types of electric service, lighting, telephone and interior signaling are cared for in the ducts, with metallic separation between each in ducts and boxes. Pilot screws are left flush in the flooring after pouring or laying to enable duct locations to be quickly found and the requisite outlets spotted by measurement.

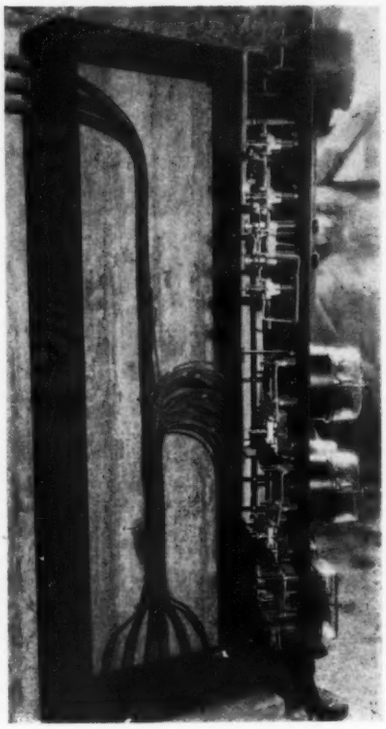
It requires about fifteen minutes to locate and clear an outlet after the job has been completed, plus a maximum of about 45 minutes more for installing a riser to a desk and pulling in wire, compared with from one-half a day to a day to cut up the floor and install a new conduit and box. It is stated that the first cost of installing this system is not greatly in excess of that of providing ordinary conduit lines and that the elimination of the annoyance and of the cost of tearing up flooring for future changes offered economies sufficient to determine the use of this method in this installation. In the light of experience gained on this job it has been determined that subsequent installations will have a 30-in. spacing between outlets. The Hixon Electric Company, Boston, was the wiring contractor for this job.



Cabinet Type Control Board Saves Space

WHERE space is at a premium, as in steam plants and many industrial plants, the cabinet type of control board shown in the accompanying illustration has a wide field of application. It shows an installation of a Westinghouse control board in the basement of station C steam plant of the Pacific Gas & Electric Company in Oakland.

The instrument board is of thin metal and is hinged so that it may be swung open like the door of a cabinet for making inspections or repair of wiring and apparatus back of the board. The shallow metal cabinet is mounted on a concrete column and occupies a minimum of space. A rigidly mounted board set out from the column a sufficient distance to provide access to the back of the board could not have been considered in this case owing to lack of space.



Hinged control switchboard with flexible connections requires minimum space

Construction in Acid and Copper Plants

By A. A. Weiss

Chief Electrician Tennessee Copper Company, **Copperhill, Tenn.**

OPERATING a large copper smelter and the largest sulphuric acid plant in the world made the conditions governing our electric installation exceedingly severe and made our construction methods peculiar to our needs. Many excellent devices and methods are not available for our use, on account of these conditions, which among more ordinary difficulties mean sulphur fumes that deposit on everything and in moist or wet weather form a very corrosive and conductive surface. To this must be added direct sulphuric acid condensation. So our construction methods are largely adapted to meet these conditions and have been evolved by years of experience with them.

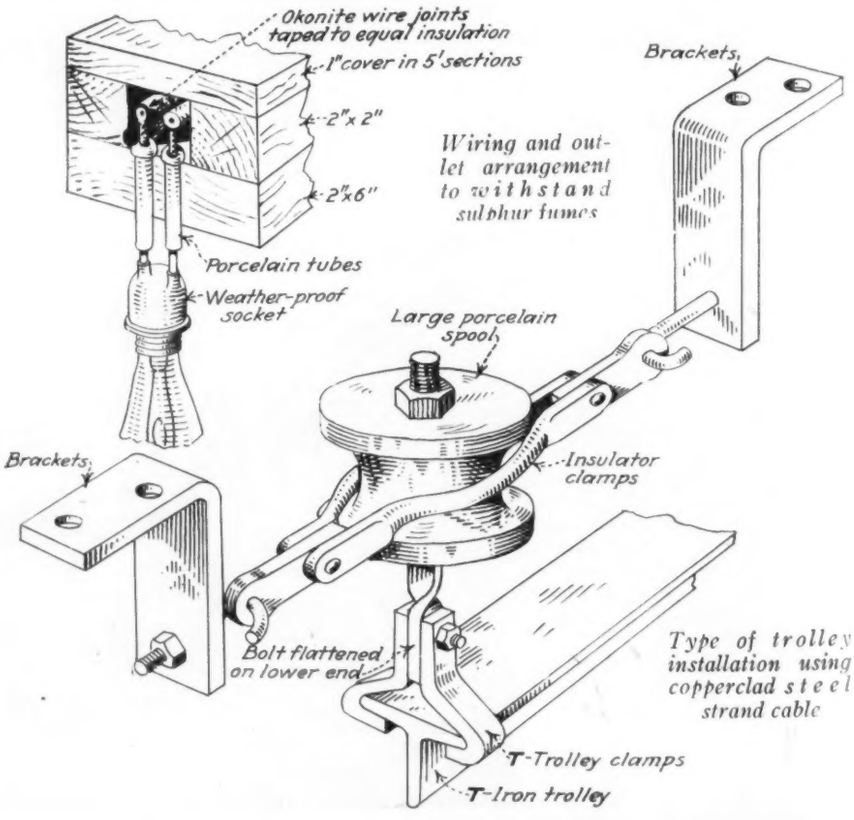
It was at one time our practice to rewire our acid plants annually; that means everything—new sockets, wire, switches, cutouts, etc. A suggestion was made to use Okonite wire in a wooden trough. This was tried out on a small section and proved so satisfactory that we have for seven years adopted it as standard for our acid plant wiring. During this period it has never been rewired and we have had no replacements to make, excepting the W. P. sockets. These last only a short time as the fumes eat out the metal tip connection.

It was also our annual practice to rebuild our trolley suspension system which was subject to the same bad conditions. At that time we used extra galvanized steel strand. We then went to copper strand supports, to avoid this annual rebuilding. The copper strand was subject to little deterioration from the acid fumes and sulphur, but had no mechanical stability—expanding with heat but failing to contract under stress. We then adopted copper-clad steel strand, which solved our difficulties. This has been up for three years without replacement. Also, the corrosion at the insulator attachment points has been reduced. Wherever possible we have substituted permanent wooden trusses for trolley hanger supports, using bridge hangers in place of wire. This construction lasts for ten years or more, with practically no maintenance and no trouble from insulation breaking down, an important safety feature.

Our construction is largely in conduit and subject to frequent alterations. We have found a great saving of time and labor in the use of the new threadless pipe fittings. In making alterations these are invaluable as it is possible by their use to cut into a conduit system without any other changes. The time saved has often a double value by reducing the out-of-service time of some motor or light system.

Another feature is the use of varicolored wire for multi-wired signal and button systems and in any case where it is desirable quickly and surely to distinguish any particular wire. This feature has long been standard telephone practice, but has not been generally adopted in the industrial field, as witnessed by our difficulty in obtaining colored wires or wires with a colored tracer good for 250-volt circuits.

Finally, we keep our construction material stocks down by standardizing on $\frac{3}{4}$-in. and $1\frac{1}{4}$-in. conduit and fittings and No. 12 and No. 6 R.C. wire for our smaller 220-volt motors and our large 2,200-volt motors. We carry these sizes in 2,500-volt insulation.



News of the Industry

New England Men Hear of Year's Advance

Purposeful Meetings at Poland Springs Convention—Defense of the Industry's Right to Tell Its Story and Champion Its Policies

STANCH defense of the right of the electrical industry to tell its story of achievement and to champion its policies before the bar of public opinion, coupled with inspiring addresses and reports featuring healthy progress in every important field of electric utility development in the Northeast during the past year, characterized the twentieth annual convention of the New England Division of the National Electric Light Association, held this week at South Poland, Me., with a large attendance.

On Monday evening the opening session was preceded by a pageant of light staged by the women's committee. President Fred D. Gordon's address sounded a note of optimism in the face of political attacks upon the industry, which he likened to the attempts of rats to gnaw away the work of beavers. The success of the power industry has drawn these attacks upon it, Mr. Gordon said, but no reason for dismay exists so long as the industry continues to realize its responsibilities to the public, to its employees and to the investor.

P. S. Arkwright, president of the national body, in a finely tempered address set forth many popular misconceptions of the light and power business, contrasting the restrictions and regulations under which it labors with the untruths and misstatements of many political self-seekers. The downward trend in rates for nearly a half century, the insignificance of electric service prices as an item in the family budget and the popular fallacies concerning water power were emphasized. Paul S. Clapp, managing director of the N.E.L.A., and Past-president H. T. Sands also spoke briefly, after which excellent progress in rural electrification was described by F. A. Belden of Boston.

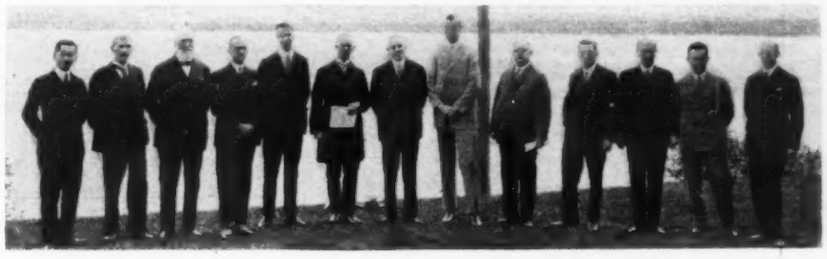
Sales activities featured a short but live session Tuesday morning, A. S. Moore presiding. Miss Alice M. Baker of the Hartford Electric Light Company spoke on salesmanship from a woman's viewpoint, emphasizing the importance of imagination in sales psychology. N. T. Wilcox of Stone & Webster outlined recent progress in electric refrigeration equipment and sales methods. C. Ernest Greenwood, commercial director N.E.L.A., spoke with enthusiasm of the new epoch in commercial thought and action now apparent. Miss Sara Harris, assistant secretary Utica Gas & Electric Company, then gave an able talk on "Team Work for Progress."

The public relations session Tuesday evening was marked by an admirable address by S. T. MacQuarrie, director New England Information Bureau, on the national utility situation and a talk on "Industrial Expansion and the Utility," by John B. Reynolds of Chicago. On Wednesday and Thursday interesting accounting, women's and engineering sessions were held.

Lighting Congress an Unqualified Success

International Illumination Commission Meeting at Saranac, N. Y., Affords a Theater for the Rapid Exchange of Information, Ideas and Practices

FOLLOWING the tour of the principal cities of the eastern part of the United States already reported in these columns and the Toronto meeting of the Illuminating Engineering Society, the seventh meeting of the International Commission on Illumination was held at Saranac Inn, Upper Saranac, N. Y., this week, as the final part of the first International Illumination Congress. All phases of the science and art of lighting were covered, including street lighting, automobile headlights, distribution of luminous flux, natural daylight, school and factory problems, aviation work, diffusing materials, residence lighting, photometry and standards, motion picture requirements, show-window practices and miscellaneous related topics. Proceedings were conducted in English, German and French, the necessary translations being made of reports and discussions. More than one hundred foreign and American representatives were present and ten nations were represented.



(*Photographed especially for the* ELECTRICAL WORLD)

Some prominent delegates to the International Illumination Congress

Left to right—Motono (Japan), Watson (Great Britain), Chappuis (France), Meyer (Germany), Secretary Walsh (Great Britain), President Paterson (Great Britain), Lieb (United States), Halbertsma (Holland), Sharp (United States), Schlögl (Austria), Filliol (Switzerland), Belkind (Russia), Henke (Sweden).

In welcoming the delegates, John W. Lieb, vice-president New York Edison Company, described it as a contribution to the happiness, welfare and protection of mankind. Dr. C. C. Paterson of Great Britain, president of the International Commission, in his report of the work accomplished since the last plenary session in Geneva in 1924, pointed out that the purpose of the meetings is twofold, namely, the furtherance of better international understanding and agreement and the study of methods prevailing in the science and art of illumination with a view to further improvements.

The opening session was devoted to street lighting in its many phases. E. Payot of Switzerland, presided. The German secretariat committee, headed by W. Wissmann, reported upon prevailing practices in the several countries and brought forward ten points by which all street-lighting developments should be governed. Dr. Paterson reported upon the British standard specifications. The physiological fundamentals involved were pointed out by Dr. L. Schneider (Germany) as involving contrast sensitivity, form sensitivity, perception time, speed of contrast perception and speed of form recognition. A contribution by A. K. Taylor (Great Britain) covered the reflection characteristics of road surfaces as determined in laboratory observations upon sections of old pavement. A special procedure and rotating chart for the calculation of lighting requirements on roads was explained by A. Gouffé (France).

Preston S. Millar (United States) presented a statement by the committee on street lighting of the Illuminating Engineering Society regarding street lighting principles, based upon the desiderata of promoting safety and con-

venience in the streets through adequate visibility and enhancing community values. Mr. Millar also presented a report covering the fundamental illuminating engineering aspects of the problem. The status of traffic control in America by illuminated color signals was covered by C. A. B. Halvorson (United States) in his report. A résumé of the general condition of street lighting in Japan was given in a contribution by M. Oga.

Discussion at the morning session ranged around the advisability of using either minimum or average horizontal illumination for measurements of intensity and whether a few inches or several feet of elevation should be used for the test plane. Chairman Payot, I. Schlögl (Austria), W. Trüb (Switzerland), Thomas W. Rolph (United States), A. F. Dickerson (United States), J. F. Colquhoun, C. C. Paterson and J. M. Waldram (Great Britain) and Preston S. Millar took part.

The afternoon sessions were devoted to the problems of glare, automobile headlights, distribution of luminous flux and photometric test plates. Participants were W. S. Stiles (Great Britain), Preston S. Millar and S. McK. Gray (United States) and E. J. Stewart (Great Britain).

A report on the study of the distribution of flux from lighting devices, by J. Wetzel (France), as well as one on the definition of lighting appliances by the method of flux distribution by H. Desarces and D. Demeure (France), led to a discussion to which G. Wilson (Great Britain), A. L. Powell (United States) and L. Schneider (Germany) contributed, developing the necessity for an international nomenclature so that specifications may be readily compared and understood.

Education in Lighting

While interesting sociological problems were introduced and discussed in contributions prepared by P. J. Waldram and J. G. West (England), who considered "Daylight and the Public Health" and "Planning for Daylight," and while the technical analysis of the distribution of energy in daylight offered by H. H. Kimball (United States) was valuable, as was the paper by J. A. MacIntyre and H. Buckley (England) regarding the protection of pictures and museum pieces from fading, the feature of the Tuesday morning session of most immediate practical interest was the report on the status of lighting education. The national committee of the United States presented questions on this subject which concerned general educational activities, intensive training in lighting (involving instruction in engineering and lighting practice subjects beyond fundamental physics in colleges, engineering schools, elementary schools and within the industry itself), lighting demonstrations, and lectures, articles and publications.

L. Schneider (Germany) reported lighting education by manufacturers, central-station companies and schools in that country to be a close parallel of that in America. Dr. Bausenwein (Austria) pointed to 24,000 stores in which improvements were produced last year. In Brussels, Belgium, according to C. A. Atherton (United States), every school child above a certain age must go to the lighting institute conducted by one of the lamp manufacturers for a course in fundamentals of lighting, returning each year for progressively advanced work. G. Wilson (England) pointed out the failure to include physiological factors in the studies, except in Germany. W. E. Bush (England) cited as an unusual development the British Electrical Association for Women, organized by the women themselves to increase the comforts of the home through the use of electricity. C. W. Sully (England) declared that his country needed to have the lighting industry work with the architects. Julius Daniels (United States) told of an American utility which employs an architect and a special engineer to cover the field of illumination planning.

At this session several speakers, including A. L. Powell (United States), confessed to having felt preliminary fears as to value of holding the international meeting in this country, but declared the congress an unqualified success in affording a theater for the rapid exchange of valuable information, ideas and practices.

On Tuesday afternoon problems involving the constitution and organization of the International Commission on Illumination were discussed, following the reports of Philip Good (Great Britain) on international organization and C. H. Sharp (United States) on the objectives and constitution of the commission.

[The Electrical World's report of Wednesday's and Thursday's sessions is unavoidably held over on account of the pressure on space.]

Entertainment features of the program included a lecture on Sunday evening on the philosophy of invention, by John W. Lieb. This address was made a part of the official proceedings. Following Mr. Lieb, Prof. Vladimir Karapetoff gave an hour of interpretative music. On Monday evening the president's reception and dance was held. On Tuesday W. D'A. Ryan lectured on spectacular exposition lighting, illustrating contemporary advances.

Public Utilities' Side to Be Presented

Federal Trade Commission Will Give Their Counsel a Hearing—Employment of News Bureaus and College Men by the Industry Is Investigated

By Paul Wooton
Washington Correspondent of the Electrical World

THAT Robert E. Healy, chief counsel of the Federal Trade Commission, who is conducting the examination of witnesses in the public utility investigation, is anxious to have the record give a true picture of the various activities brought under scrutiny was made evident at the hearing on Sept. 25, when he suggested to Commissioner McCulloch, who is presiding, that an opportunity be accorded the attorney for the utilities to amplify extracts taken from speeches of public utility executives with such other extracts from the talks as they think necessary to present their attitude fairly. Some of the witnesses scheduled to appear this week for the inquiry into the activities of the Southern Appalachian Power Conference were delayed, and that hearing was postponed until Oct. 3, when Dr. Joseph Hyde Pratt, chairman of the conference; Prof. J. A. Switzer, secretary of the conference, and Thorndyke Sayville, the former treasurer of the conference, will be heard.

Bernard F. Weadock as counsel for the Joint Committee of National Utility Associations renewed the pledge of his principals to co-operate fully throughout the investigation and asked in return the privilege of a hearing to cover the activities of the industry, so that the public might have a full story. The request was granted. The time of hearing will be assigned later.

Mr. Weadock also asked that a school pamphlet typical of others now filed as exhibits be printed as part of the testimony. Commissioner McCulloch, however, denied this request.

Marcy B. Darnall, owner and publisher of the Florence *Herald* and the Darnall News Service, Florence, Ala., then was called to the stand. The examination showed that he has received about $4,000 from the Alabama Power Company in the past three years for distributing gratis copies of his news releases. He has sent out 200 copies weekly under partial direction of the company, reaching at some time all weekly papers in Alabama, Mississippi, Georgia and Florida. Lists were changed each week. The power company's connection was not mentioned to recipients; the releases were sent as sample copies, sometimes with return cards by which subscriptions to the service were secured.

Mr. Darnall has consistently opposed federal development of Muscle Shoals by strong statements in his news sheets. He said that his policy always has been against government control. He scouted the idea that the payments from the power company had biased his opinions.

C. M. Kilian of Atlanta, secretary of the Southeastern Division of the N.E.L.A., testified as to activities of his organization. The expenditures of his office, financed from the national headquarters in New York, have been

rapidly increasing and in the past fiscal year amounted to $20,000. Mr. Kilian said he served in a purely secretarial capacity, making no contacts and doing no publicity work, although he had been previously engaged in professional advertising. He was called to the stand chiefly for identification of financial statements and copies of speeches. One of the documents identified was a report of remarks made before a public relations session of the 1924 convention of the Southwestern Division in Birmingham by P. S. Arkwright, now president of the N.E.L.A. as well as the Georgia Power Company. Here are extracts:

"School children, constantly seeing the name of the company associated with facts about the state's greatness, are beginning to associate the company itself with the progress of the state."

"It is essential that some method be adopted by which a correct understanding of the economic problems governing this most vital [power] business can be got into the minds of students so that they will not come out of college with the wrong idea. But it is a very delicate subject."

It was stated in the report that M. H. Aylesworth, then managing director of the N.E.L.A. and now president of the National Broadcasting Company, with reference to conventions of the association said: "Don't be afraid of the expense. The public pays the expense. Let us continue with these big meetings."

The next witness was Dr. J. S. Thomas, director of the extension division, University of Alabama. He testified that he has been connected with and has received a salary from the university continually for the past sixteen years and has also been paid for a number of outside activities. During the first six months of 1927 he acted as director of the Alabama Utility Information Bureau, after which the bureau was discontinued at his suggestion. His salary of $8,000, paid by the Alabama Power Company, kept on, he explained, until his recent appointment as associate director of a newly formed State Board of Industrial Development. This board was underwritten by Thomas W. Martin, president of the Alabama Power Company, and by four other private persons, who contributed $5,000 each.

When asked if he were an engineer, Dr. Thomas replied that he is in a sense. Called upon to explain, he said he is interested in problems of economics and sociology which are closely allied with engineering, and therefore he feels that he might be called an engineer, although he has never practiced or received a degree in any of the usual branches.

Without much questioning, the witness explained his activities by saying that for sixteen years he has been vitally interested in the welfare of Alabama, recognizing that a commonwealth 79 per cent rural and agricultural must look toward industrial development as the only means of expansion. As a result he crusaded up and down the state, "with the enthusiasm of a schoolboy," in the promotion of this idea, speaking before Rotary, Kiwanis and Civitan clubs and public gatherings. Asked if it was known at these meetings that he was in the employ of utility companies, Dr. Thomas replied in the negative. Dr. Thomas claimed he never spoke except by request and that arrangements for his talks were solicited by no one. He addressed but one power company gathering, for which traveling expenses were defrayed by the N.E.L.A.

When Judge Healy asked why a salary was necessary after Dr. Thomas had crusaded for state industries so enthusiastically for many years without pay, the latter replied that with the salary his activities were more intensified than before.

Albert T. Reed of New York testified on Wednesday that he was paid $8,000 during the ten months ending with May, 1928, as a retainer for services on behalf of the utilities. Mr. Reed is a cartoonist, an advertising counselor and a specialist in advertising art. He furnishes cartoon service to about thirty daily papers and to a syndicate serving about two thousand weeklies. During his connection with the Joint Committee he mapped out an advertising campaign for which he submitted text and layouts. None of this was published.

Judge Healy brought out that checks were first drawn directly to Mr. Reed and later to J. S. S. Richardson, publicity director of the Joint Committee. Mr. Reed explained that the arrangement was made because Mr. Richardson's principals did not wish to be connected with a general advertising campaign, but was unable to tell why, this being the case, his services were continued through Mr. Richardson. He could offer as evidence no correspondence or contracts inasmuch as all agreements had been oral. No cartoon service was furnished the Joint Committee. During the period through which Mr. Reed was retained only six or seven out of about four hundred of his cartoons touched upon any form of government ownership. He denied indignantly that his employment by representatives of the utilities had any bearing on the subject matter of his cartoons.

The commission announced that witnesses will be heard as follows on Oct. 10 and 11: R. M. Hofer, manager E. Hofer & Sons' News Service, Salem, Ore.; Berkeley Snow, secretary Northwestern Electric Light and Power Association, Portland, Ore.; W. R. Putnam, treasurer Idaho Committee on the Relation of Electricity to Agriculture; H. L. Walter, manager Oregon Public Utility Information Bureau, Portland, and Mrs. Claire Tripp, Washington Industries Education Bureau, Seattle.

The inquiry into the activities of the state information bureaus has about been completed, and the commission is planning to go into the publicity activities of individual companies.

Purchases and Mergers

Independent California Utility Purchased by A. E. Fitkin—High Price Offered for Municipal Plant in Small Texas City

ONE of the few remaining independently operated light and power utilities in California, the Coast Counties Gas & Electric Company, has been acquired by A. E. Fitkin, well-known nationally as a public utility operator, who announced purchase of the outstanding common and second preferred stock of the company on Sept. 22. The purchased company had assets as of Dec. 31 last of $8,494,250 and supplies gas and electric service to more than fifty communities along the Pacific Coast in the vicinity of Santa Cruz, Calif. Management of the property will be under the United States Engineering Corporation, a holding company of the A. E. Fitkin organization.

The Central Power & Light Company has made a formal offer to purchase the municipal power and light plant of Harlingen, Tex., for $1,580,000, this representing the bonded indebtedness of the city, according to Mayor Finley Ewing. An election on the question will be called. Sale of the plant was voted on and defeated last year.

Brewton, an Alabama town of 3,000 population, 75 miles from Mobile, has voted by three to one to sell its municipal electric plant to the Alabama Power Company for $125,000.

Application for the right to purchase the Tilghman Ice & Electric Company has been filed by the Maryland East Coast Utilities Company with the state commission.

The Oregon-Wayne and the Lebanon-Wayne Power & Light Companies appeared before the Pennsylvania Public Service Commission last week for approval of their incorporation and the right to begin operation. They will be taken over by the Pennsylvania Power & Light Company.

The municipal lighting plant of Souderton, Pa., has been disposed of to the Pennsylvania Power & Light Company for a price said to be $150,000, which covers the distribution system.

A crowd of citizens numbering about two hundred appeared before a meeting of the borough commissioners of Vineland, N. J., last week to demand that a referendum be taken on the commission's plan to sell the municipal electric plant. The commissioners had resolved to offer it for sale, restricting offers to residents of New Jersey and public utility corporations. The plant is rated at 2,300 kva.

Power Exposition in New York to Open Dec. 3

The seventh National Exposition of Power and Mechanical Engineering will be held, as usual, at the Grand Central Palace, New York City, opening on Dec. 3 and closing Dec. 8. Already space for 793 exhibits has been reserved. These are classified as follows: Power, 356; transmission equipment, 110; heating and ventilating, 156; machine-shop section, 80; miscellaneous group, 91. The American Society of Mechanical Engineers, the American Society of Refrigerating Engineers and the American Institute of Chemical Engineers all will convene in exposition week.

Coal Charge Eliminated in Greater New York

President of the Four United Companies Announces a Reduction of $4,500,000 by Which 99 per Cent of the Consumers Will Benefit

FULL-PAGE advertisements appearing in the New York City daily newspapers of Thursday, Sept. 27, signed by M. S. Sloan, president of the four recently consolidated light and power companies of the metropolis, which serve all but a small number of its six million inhabitants, announce that, as a first step toward reduced charges made possible by the union of the Brooklyn Edison Company with the other three, and with the approval of the New York Public Service Commission, the surcharge added to bills of consumers for coal costing the companies more than $3 a ton will be eliminated on Oct. 1 as regards the bills of 99 per cent of the companies' customers, including household users and retail stores. The coal charge will also be reduced to large users and wholesale customers.

Mr. Sloan estimates that this will represent a saving to consumers of about $4,500,000 a year. "This is only one of the things we expect to do for the users of electricity in New York," he said. "We have taken up the coal charge first because it was something we could get at immediately." The present price of coal to the companies is $5.15.

Niagara Gains 5,000 Hp.

Power Commission Issues 90-Day License to Power Company to Cover Remaining Treaty Water—Ottumwa Plans Development

ISSUANCE of a 90-day license to the Niagara Falls Power Company covering the remaining 275 sec.-ft. of treaty water at Niagara Falls was authorized by the Federal Power Commission at a meeting held Sept. 24. This is the water formerly used on Eighteen-Mile Creek, near Lockport, N. Y. The license was surrendered so as to allow the more efficient use of the water at Niagara Falls. The Niagara Falls Power Company applied for an amendment to its principal license so as to include this 275 sec.-ft., but under the new rule of the commission the amendment cannot be acted upon for some time because no agreement has been reached on pre-license costs. The auditor of the commission is now working on the company's accounts. In the meantime the 5,000 hp. which can be generated at Niagara Falls from this water is made available to the industries in that region by the temporary license.

The city of Ottumwa, Iowa, has applied to the Federal Power Commission for a preliminary permit covering a project on the Des Moines River, in Wapello County, Iowa, within the city limits of Ottumwa. It is proposed to open a new channel for the river by widening the headrace of the present power plant and to construct a dam, consisting of a series of large gates, and a power house. The existing dams in Des Moines River at Turkey Island will serve as diversion dams to force the water into the proposed channel. The power is for municipal use and for sale to the Iowa Southern Utilities Company for public utility purposes. The primary power made available will be 3,120 hp.

Smith Elaborates Views on Water Power

Democratic Presidential Candidate, at Denver, Repeats Demand for Government Ownership—Discusses St. Lawrence, Boulder Dam and Muscle Shoals

SPEAKING at Denver on Saturday night, Sept. 22, in the course of a Western campaigning trip, Governor Alfred E. Smith of New York, Democratic candidate for the presidency, devoted his entire address to his views on water power, elaborating the party plank and his own previous expressions made in his speech of acceptance. Incidentally he attacked the appointment of Roy O. West as Secretary of the Interior and of H. E. Machold as chairman of the New York State Republican Committee, on the ground that both had been identified with power interests.

When he came to the investigation of utilities now being conducted by the Federal Trade Commission, Mr. Smith displayed a lack of information or a confusion of mind as to the respective organization and functions of the Joint Committee of National Utility Associations, the National Electric Light Association and the various state utility information bureaus and made a number of inaccurate statements, some of which were pointed out on the following day by Stephen Davis, the director of the Joint Committee. The crux of the Governor's speech, however, did not lie in these, but in what he had to say on the relation of government to water-power development and on the specific problems connected with the development of the St. Lawrence, with the Muscle Shoals plants and with the Boulder Dam project. Space limitations make it impossible to reprint his utterances on these subjects, which have had nation-wide circulation in the daily newspapers, but the excerpted sentences in the accompanying panel give their general purport.

Governor Smith Says:

I make the claim that the benefit of their [power sites] development should accrue to the people themselves and that we should not permit them to fall into private hands for private development, which means private gain at the expense of all the users of the energy.

I claim that where they are owned by the government they should remain under federal control, where they are owned by an individual state they should be under the control of that state, and where they are owned by states jointly they should be under the control of those states. By control I mean absolute retention of the ownership of the power itself, by owning and controlling the site and the plant at the place of generation.

To my way of thinking, a fifty-year lease is equivalent to the alienation of them [power sites].

If in the light of that report [the coming engineering report on Boulder Dam] and the attitude of the several states involved, it shall appear that the speediest and most effective way to bring about this great improvement is to have the government build it, and Congress should so determine, it would be the duty of the President to abide by that decision and hasten the work upon that dam.

Never should this priceless right be given away for private exploitation, and in whatever form the power generated at Boulder Dam shall be distributed, public authority must retain the contractual right to control the rates to be charged to the ultimate consumer and to control by contract the fair and reasonable distribution of the power to be generated.

As to Muscle Shoals, I believe that the government should continue the full and complete development of that plant, retaining it under government ownership and control.

Electric Railway Men Have Enthusiastic Convention

With an attendance of about four thousand, crowded sessions, excellent papers and addresses and animated discussions, the forty-seventh convention of the American Electric Railway Association in Cleveland this week repeated its successes of former years. A brief outline of those parts of the program of most interest to light and power men was printed in the ELECTRICAL WORLD for Sept. 15 (page 528). An attack on the five-cent fare obsession was made by Owen D. Young, chairman of the board of the General Electric Company. Mr. Young declared his unfaltering belief in private ownership of public utilities, the only exception being "some public services which have such large social significance that they cannot be translated into economic terms, and, therefore, private capital cannot be called upon to meet such needs."

The Virginia Electric & Power Company won the Coffin medal. James P. Barnes, president Louisville Railway Company, was elected to succeed R. P. Stevens as president of the association.

A.S.M.E. National Fuels Conference

Cleveland Meeting Covers Wide Range of Coal Combustion Problems—Pulverized-Fuel Firing Discussed—Coal Producers Advised to Unite for Research

THOMAS T. BAKER, president Carnegie Institute of Technology, in his opening address to the national fuels meeting of the American Society of Mechanical Engineers in Cleveland last week, counseled the coal-mine owners to unite for research. The matters covered in the fourteen sessions of the four-day conference (Sept. 17 to 20 inclusive) ranged from Mr. Baker's consideration of the "Perils and Profits of Research" through the various manners and methods of coal burning to the problem of smoke abatement in cities. Of especial interest to central-station engineers were papers on pulverized-fuel firing, stoker design, burning characteristics of different coals, feed-water conditioning, boiler baffling and furnace refractories.

Pulverized-Fuel Firing

The first of these listed subjects was treated in six papers. The fineness of pulverized fuel as affected by mill types was discussed in a paper by Lincoln T. Work, who reported an investigation that showed that the various principles of mill action produce fuels of different fineness. The quality of fineness in the fuel affects its behavior in the furnace as expressed in boiler efficiency, smoking, rate of combustion and radiant-heat generation.

A description of past developments and of the present state of the art of collecting dust from flue gases in powdered-fuel installations was given by Kurt Toensfeldt. John Blizard discussed the general question of unit-type pulverizers, describing the duty of this equipment and the requirements of its construction. The progress in pulverized-fuel firing of marine boilers was treated by T. B. Stillman. A summary of pulverized-fuel experience at the Cahokia station of the Union Electric Light & Power Company, St. Louis, from the standpoints of performance and dollar value, was given by E. H. Tenney. A feature of this paper was a comparative tabulation of characteristics and test, operating and cost data on five Cahokia boilers, four of them using the storage system and the fifth the unit mill. The unit-mill installation showed a total of operating costs and fixed charges considerably less than the other type. In treating of furnace and burner design for pulverized fuel, E. G. Bailey described a number of different installations from which he drew conclusions as to the requirements in these items.

One of the most interesting papers presented at the meeting was that by Henry Kreisinger and B. J. Cross on the burning characteristics of different coals. This paper very appropriately followed one by A. C. Fieldner on the constitution and classification of coal. The latter paper described work now in progress to arrive at a comprehensive system of coal classification so that the characters, constituents and possible uses of various coals might be expressed in common standard terms. The Kreisinger and Cross paper presented the combustion performances of the different American coals from the Connecticut graphitic to the lignites and peats of the Southwest and West. Both of these papers came in for prolonged discussion.

Conditioning Feed Water

In the present era of high boiler pressures the importance of feed-water conditioning is emphasized. The principal necessity for the solution of problems affecting modern boiler operation is the collection of adequate operating records from which true pictures of boiler performance may be obtained. There are no panaceas for feed-water troubles, and the cures for the various ills of foaming, deposition of scales and sludge, boiler-steel embrittlement and other afflictions must be arrived at scientifically. So stated R. E. Hall in speaking of present tendencies in feed-water conditioning. Cross-baffling of vertical boilers showed certain performance advantages over the common present practice of vertical baffling in the small and medium-sized boilers to which it has so far been applied, according to A. C. Danks in his paper on that subject. An interesting possibility in the future development of coal-burning practice was treated by W. B. Chapman, who reported the progress being made toward direct firing of boilers with producer gas.

After reviewing the customary procedure in obtaining competitive bids, F. M. Van Deventer, in his paper on the determination of economic value in the selection of power-plant equipment, discussed the commonly used criteria of relative values. He drew definite conclusions concerning the correctness and merit of these criteria. These conclusions were demonstrated by two examples, the first the determination of the size of an air preheater and the second the comparison of competitive bids on this equipment. The procedure by which these results were arrived at was summarized in the paper.

Recent developments in and modern design of stokers were described by Joseph G. Worker and Joseph S. Bennett. This paper listed ten fundamental principles for efficient burning of coal and showed how, by the use of automatic draft control, wide range in rate of coal feed and other features, the modern stoker satisfied these requirements. Asserting that there is now no co-ordinated and complete information on the behavior and requirements of furnace refractories, C. F. Hirshfeld and W. A. Carter, in their paper on this subject, recited the progress being made in this line. This research, which is sponsored by the United States Bureaus of Mines and of Standards and by the A.S.M.E., includes study of actual service conditions. The paper, as well, covered the available experience data on refractory performance and contained certain advice on things to do and things not to do in furnace-wall construction.

Studies of the national coal resources, industrial and domestic fuel uses and the civic problem of smoke abatement all received adequate attention. To those interested in fuel from any angle this Cleveland meeting held matters of direct import and value.

New Mexican Farmers Beat Elephant Dam Contract

Failure of land owners of the Elephant Butte Water Improvement District in the New Mexico part of the Rio Grande Valley in an election held on Sept. 15 to give the necessary two-thirds majority in support of the pending contract with the El Paso Electric Company will cause the project of constructing a hydro-electric plant at the Elephant Butte Dam to be abandoned, at least temporarily, it is thought. While the Elephant Butte Water Improvement District defeated the proposal, the water users of the El Paso Water Improvement District in Texas voted in favor of it by more than two-thirds majority.

According to the terms of the contract voted on, the two districts controlling the development of power from Elephant Butte Dam, if the joint contract had carried, would have united for the construction of an electric plant which would have used water flowing from the spillways for the generation of electricity. The contract bound the water users to furnish the El Paso Electric Company with power for the next 25 years, for which they were to receive in return a minimum guarantee of $180,000 a year.

Street Light and Other Rates Down in Los Angeles

The California State Railroad Commission has granted the Los Angeles Gas & Electric Corporation's application to reduce its charges for ornamental street lighting in the city of Los Angeles. The corporation asked to have the new rate set at 3 cents per kilowatt-hour, but the commission ordered a schedule based on watt capacity which amounts to about 3½ cents, or approximately $6,000 a year. The rate in effect now is 4 cents. The commission carried the order further by recommending a cut in the company's commercial and domestic rates which will mean a saving of more than $300,000 a year to the consumer. The commission declared that the corporation was in a prosperous condition and

that its commercial rates are not in line with the amount of its earnings. If the suggested cut is not made voluntarily by the company "within a reasonable time," the commission indicated that it will enforce it. Paul Overton, general counsel for the Los Angeles Gas & Electric Corporation, declared that the commission's order was "a complete surprise," there having been no hearing upon commercial and domestic rates.

The new ornamental light rate applied to all street-lighting districts will, it is predicted, mean a saving to taxpayers of approximately $180,000 per year, as it is anticipated that the other bodies furnishing this service will meet the Los Angeles Gas & Electric Corporation's new schedule. The Municipal Bureau of Power and Light has taken steps to meet the whole issue by filing with the City Council a new electric lighting and power rate schedule for its service. It is estimated that more than a million dollars a year in light and power bills will be saved by these reduced rates.

Valuation and Rate Situation in Portland, Ore.

Postponement of the formal hearing on concurrent investigations of the valuation of the properties of the Portland Electric Power Company by the city of Portland and by the Public Service Commission of Oregon from Oct. 1 to Nov. 1 was decided at an informal hearing on Sept. 20. Both the city and the commission are expected to have completed their investigations by that date. Agreement was also reached that the case to be heard Nov. 1 is to include only the properties of the Portland Electric Power Company.

The rate investigation has been going forward since its inception last May. Efforts of Kenneth G. Harlan, rate engineer of Tacoma, retained at $48,000 by the city to conduct the city's case, to have the Northwestern Electric Company's properties also included in the investigation by the city have been unsuccessful, since city officials present at the meeting of Sept. 20 indicated that the city could not afford to pay him the additional $75,000 asked for this work. The commission proposes to undertake a valuation of the properties of the Northwestern Electric Company as soon as its present investigation of the Portland Electric Power Company is concluded.

A reduction in power rates for customers having an average demand of 375 kw. or more, amounting to from 10 to 30 per cent, depending on the load factor, was offered Sept. 18 to industrial users in Portland by the Portland Electric Power Company and the Northwestern Electric Company. The new rate, which encourages high-load-factor utilization, reduces the top step from 5 cents to 3½ cents per kilowatt-hour and the lowest step from 8 mills to 2½ mills. The reduction will save present power users in Portland between $60,000 and $70,000, based on 1927 consumption.

Long-Distance Management a Myth

So Says President Arkwright at Saranac Meeting of Empire State Association—Section and Committee Chairmen Heard From—Foresight Characterizes Gathering

"THERE is no such thing," said Preston S. Arkwright, president National Electric Light Association, in addressing the twenty-fourth annual convention of the Empire State Gas and Electric Association at Upper Saranac, N. Y., last week on the subject of "The Danger of Attempting to Operate Local Public Utilities Through Long-Distance Management." "No matter how great the property may be, . . . it is dependent exclusively upon local control and the wishes of the people," Mr. Arkwright declared. "The community value is the basis of all utility business. . . . The holding company is the best form of organization, in the public interest, for the development of the electric and gas companies. . . . The holding company produces the benefits of mass production, economies and local management without involving consolidations."

Other speakers at the two-day meeting of the association on Thursday and Friday covered a variety of subjects related to utility activities. President R. O. Palmer called on his committee chairmen to present suggestions for activities of their sections during the coming year and himself made a statement of the problems confronting section members instead of following precedent and reviewing past work.

Good Section Reports

The good-will value of safety instruction and accident-prevention initiative were stressed by R. V. Rickcord, chairman of the accident prevention committee. Mr. Rickcord said that a survey of a number of utility companies indicated that the payments to employees because of accidents represented 2 to 6 per cent of the payroll, one company having made an annual expenditure of $400,000 in direct accident costs to employees. The burden of greater safety rests directly upon the chief executive, he declared, as the situation requires a sustained interest throughout the whole organization if improvements are to be made.

H. C. Davidson, chairman of the Accounting Section, contended that accounting men should think less of the mechanism of their work and more of the fundamental economies, since "scientific rate structures depend upon intelligent cost accounting."

John L. Haley, chairman of the Commercial Section, urged the importance of the commercial man in rate problems. The present inadequate and obsolete rate structures for the residence group were particularly criticised. Mr. Haley did not make any specific structure recommendations, but pointed out the basic desirability of having the connected customer pay for what he gets and the folly of expecting one class of consumer to support another class. A facility charge was considered to be essentially fair to the greatest number of consumers.

The New York State Committee on Public Utility Information was defended by Chairman E. H. Rosenquest for its policy and activities and the future progress of continued functioning was outlined. The committee on public speaking, of which Frank W. Smith is chairman, reported upon informational, service and similar addresses by utility men and women.

Farm Economics

Prof. W. I. Myers of the New York State College of Agriculture offered detailed information regarding the economics of farm conditions in the state with particular regard to future development.

Senator J. Griswold Webb urged the co-operation of utility men in furthering the progress of aviation through the lighting of air fields and beacons. Senator Webb also pointed out the danger of transmission lines to aviators and suggested that such conductors should be at a safe distance from fields and that watercourses or other air lanes should, where intersected by utility lines be marked by a characteristic beacon to prevent night-time casualties.

The tendency to seek lower-cost types of construction with resultant lower grades of service in rural districts was decried by A. R. Tremaine of the Electric Section, who advocated one grade of service for all customers and pointed out the expense of increasing the capacity of low-cost lines. Mr. Tremaine suggested the use of taps to high-voltage transmission lines as a potentially excellent way to supply the farmer.

The Electric Meter Section, of which W. J. Consler is chairman, reported upon the requirements of satisfactory metermen and urged compensation bases which would make this work, instead of being only a temporary job for any ambitious man, a satisfactory occupation for more competent workers.

Some of the features which make New York a great industrial state and the factors which must be considered in future development and in the retention of present industries were covered by Dr. L. A. Wilson, Assistant Commissioner of Education for the state, who urged a central bureau for the compilation and dissemination of information.

Other speakers included H. E. Merrill, chairman of the Gas Section, and Helen S. Smith, chairman of the Women's Section.

Officers elected for the coming year are: President, Charles S. Ruffner, Mohawk-Hudson Power Corporation; vice-presidents, W. J. Welsh of the Gas Section and Fred A. Stoughton, St. Lawrence Valley Power Corporation; treasurer, Samuel G. Rhodes, New York Edison Company.

Electrochemists Study Process Industries

Charleston (W. Va.) Convention Affords Opportunity to Observe Practical Application — E. G. Acheson Prize Established — High-Temperature Refractories Still Problem

TAKING advantage of the location of a large number of process industrial plants in the vicinity of Charleston, W. Va., the fifty-fourth convention of the American Electrochemical Society, held in that city at the Hotel Kanawha Sept. 20, 21 and 22, combined the study of scientific problems and the practical application of electrochemistry in industry. Two hundred members of the society attended the convention, the morning sessions of which were devoted to presentation and discussion of technical papers while in the afternoons inspection trips were made to various industrial plants using electrochemical, electrometallurgical and electrothermic processes.

On Thursday morning discussions were started by Paul J. Kruesi, president of the society, this session being given over to chemical reactions at 1,000 deg. C. and above. A paper on "Thermoelectric Measurements of Temperatures above 1,500 deg. C.," by H. L. Wilson and H. Abrams, General Electric Company, described methods of measurement of temperatures from 1,000 to 2,000 deg. C. by means of a tungsten graphite thermocouple. In discussing practical application of this equipment, Colin G. Fink pointed to the need for refractories of still higher temperature to keep step with electrical progress. Discussion of a paper on the high-frequency induction furnace for chemical preparations above 1,000 deg. C., by C. N. Schuette and Charles G. Maier, Bureau of Mines, Berkeley, Cal., also brought out this need. Other technical papers, including a series on electrodeposition, maintained the society's high standard.

A feature of the meeting was the announcement of the establishment by Dr. Edward Goodrich Acheson of a trust fund in the sum of $25,000 to form the basis of an award every second year of a gold medal and a prize of $1,000 for a distinguished contribution to any of the branches fostered by the American Electrochemical Society. Dr. Acheson, in a communication to the society made through his son, John Acheson, expressed the wish that the prize should not serve as an incentive, but rather that it should provide a way in which publicly to recognize achievement. The specific contribution may consist of, but shall not be limited to, (a) a discovery pertaining to electrochemistry, electrometallurgy or electrothermics; (b) an invention of a plan, process or device, or research evidenced by a paper embodying information, useful, valuable or significant in the theory or practice of electrochemistry, electrometallurgy or electrothermics, or (c) distinguished services rendered to the society or its successor.

The society bestowed upon Thomas A. Edison the distinction of honorary membership, which Mr. Edison accepted by an appreciative telegram.

Industrial plants to which inspection trips were made by delegates included the Owens Bottle Company, Sharples Solvents Corporation, Westvaco Chlorine Products, Inc., Barium Reduction Corporation, Kelly Axe & Tool Manufacturing Company, Dickinson Salt Works, United Fuel Gas Company, Pure Oil Company, Columbia Carbon Company, United States naval ordnance plant, West Virginia Brick Company and E. C. Klipstein & Sons Company. The Appalachian Electric Power Company's plant was also inspected, and on Friday a special train took the members to the plant of the International Nickel Company at Huntington, W. Va., to study the smelting and rolling operations in the manufacture of monel metal.

The society will meet again at Toronto on May 27-29 next, for its annual spring convention.

Rocky Mountain Convention Winds up Auspiciously

Closing with a discussion of national problems by Paul S. Clapp, managing director of the N.E.L.A., the Rocky Mountain Division of that body ended on Thursday, Sept. 20, a successful convention held in conjunction with the Colorado Utilities Association. Besides the speeches noted in the opening account last week (page 579), the program included an address by E. F. McKay, manager Oklahoma Utilities Association, on "Oklahoma's Franchise Law," and one by S. B. Irelan of Kansas City on "The Value of Public Utility Investments to the Individual." Other speakers well known in N.E.L.A. circles were J. F. Owens, W. S. Vivian and M. E. Sampsell.

R. F. Throne, the new chairman of the prime movers committee of the parent body, discussed "The Effect of Engineering Developments on Load Building"; Dr. Charles A. Lory, president Colorado Agricultural College, spoke on "Public Service and Agricultural Growth"; Earl W. Hodges of Henry L. Doherty & Company told of "Building Confidence and Maintaining Good Will," and Rufus G. Gentry, Public Service Company of Colorado, took for a subject "Getting Your Message Over."

Three "effective load builders"—ranges, refrigerators and water heaters—were championed respectively by Luke R. Storey of Greeley, J. M. Eakins of Denver and W. C. Quandt of Pueblo. "The Breaking Points in the Human Machine" and "Training in Industry" were dealt with by experts from outside the association at a session on the training of employees.

Abundant opportunity for discussions was afforded at every session. At the banquet prizes were awarded and the "televox" was demonstrated by R. J. Wensley of the Westinghouse company. Entertainment was plentiful.

Winnipeg Contract in Force

In accordance with the terms of an eleven-year contract entered into about a year ago with the city of Winnipeg, the Winnipeg Electric Company transferred the first block of power into the wires of the civic hydro-electric system from the plant of its subsidiary, the Manitoba Power Company, at Great Falls, on the Winnipeg River, on Sept. 1. The city hydro is now receiving 6,500 hp. from the company, but for the first year it may take an additional 3,500 hp. if it desires. The contract calls for a supply of power ranging from a minimum of 6,500 hp. in the first year to a maximum of 30,000 hp. in the sixth year. The price is 2.68 miles per kilowatt-hour, or $15 per horsepower per annum.

Winnipeg Company Gets Seven Sisters Falls

To the Northwestern Power Company, a subsidiary of the Winnipeg Electric Company, a 30-year lease has been granted by the Canadian government for the development of the Seven Sisters Falls, on the Winnipeg River, Manitoba. An agreement has already been arrived at between the province and the company for the power from these falls. Strenuous opposition had to be overcome since the Manitoba government has advocated public ownership and to a limited extent practised it. The government hydro-electric system, which supplies power to a number of small towns and to certain rural parts of the province, has cost the province upward of a million dollars in deficits. Under these circumstances Premier Bracken viewed with favor the offer of the Winnipeg Electric Company to provide a service at $13.80 per horsepower, conditional upon the company acquiring Seven Sisters Falls.

Society for Electrical Development Elects Directors

Election of directors of the one-year and three-year classes was the chief business at the annual meeting of the Society for Electrical Development, held at New York City on Sept. 14. The following were unanimously elected, Messrs. Gilchrist, Farmer, Williamson, Burns and Ashworth for three years, all others for one year:

To represent central-station group: P. S. Arkwright, M. E. Sampsell, P. S. Clapp, John F. Gilchrist.

To represent manufacturer group: H. B. Crouse, A. E. Waller, F. R. Farmer, Gerard Swope.

To represent wholesaler group: G. E. Cullinan, E. Donald Tolles, Frank S. Price, W. W. Williamson.

To represent contractor-dealer group: C. L. Chamblin, L. W. Davis, C. M. Beltzhoover, J. F. Burns.

To represent "at large" group: F. D. Gill.

To represent local electrical leagues: R. B. Corcoran, H. A. Brooks, J. E. North, E. M. Ashworth, R. A. Gordon.

Briefer News

A. E. C. Administrative Board to Meet at Pittsburgh.—The next meeting of the administrative board of the American Engineering Council will be held in Pittsburgh on Oct. 19 and 20, under the auspices of the Engineers' Society of Western Pennsylvania. President A. W. Berresford of New York will preside.

Houston Lighting & Power Company Enlarges Substation.—An addition to its substation at Baytown, Tex., has just been completed by the Houston Lighting & Power Company at a cost of $350,000. This expansion was made to take care of the distribution of energy from the Deepwater plant for the refinery of the Humble Oil & Refining Company at Baytown.

Chamber of Commerce of the United States Appoints Water Power Policies Committee.—A special committee on water power policies has been appointed by the Chamber of Commerce of the United States to find a way, if possible, to put undeveloped water power into use. Frederic A. Delano, former member of the Federal Reserve Board, is chairman of the committee, and among its members are Lewis B. Stillwell and General Harry Taylor, former chief of army engineers.

Baton Rouge-Lafayette (La.) High-Tension Line Planned.—The Baton Rouge (La.) Electric Company and the Gulf States Utilities Company —Stone & Webster organizations—are, it is reported, to be connected by a 50-mile high-tension line from Baton Rouge to Lafayette, La., which would tie in the Louisiana capital with the distributing system of the Gulf States Utilities Company. The latter company has headquarters at Lake Charles, La., and Beaumont, Tex.

Wyoming Will Have New 70-Mile Transmission Line.—Work was started some weeks ago by the Mountain States Power Company on 70 miles of 33,000-volt transmission line which will extend from Lovell to Worland, Wyo., by way of Greybull, in order to deliver power from the transmission system of the United States Reclamation Service now serving Lovell. This line will be in a position to serve other towns in the Big Horn Valley besides those named, such as Basin and Manderson. It is to be ready on Oct. 15.

Program of American Welding Society.—For the fall meeting of the American Welding Society at the Bellevue-Stratford Hotel, Philadelphia, Oct. 8 to 12, many papers are scheduled, including those which follow: "Welding in Heating, Ventilating and Plumbing," R. A. Jack; "Testing Joints for Aircraft Structures," H. L. Whittemore and H. H. Moss; "Welds at Elevated Temperatures," Prof. C. Moser; "Welding in the Automobile Industry," J. W. Meadowcroft; "Design of Welded Structures," F. P. McKibben, and "Erecting a Building by Welding," J. F. Lincoln. Dr. Karl Bung of Germany will display a film entitled "Studies of the Metal Arc."

Central Maine Power Company Dams Sebasticook River.—Rehabilitation of Burnham dam, on the Sebasticook River, 5 miles from Pittsfield, Me., is under way to increase the generating capacity of the Central Maine Power Company. The plant will have an output of 1500 hp. The original penstock and power house will be used, although provision will be made for erection of new buildings in the future. The station is just off the Waterville-Bangor state highway. The site is already coffered and the river bottom excavated.

McGraw-Hill Publishing Company and Publisher of "Textile World" Affiliate.—Affiliation of the Bragdon, Lord & Nagle Company, publisher of *Textile World*, with the McGraw-Hill Publishing Company, which publishes the Electrical World and thirteen other technical and business periodicals, is announced by James H. McGraw, president of the company last named. The *Textile World* is the oldest business paper in its field, having been established in 1868. The Bragdon, Lord & Nagle organization will operate as a separate division of the McGraw-Hill Publishing Company. Henry G. Lord will continue as its president and Frank L. Nagle as chairman of the board.

State Authority for Osceola (Mo.) Plant on Osage River Asked.—The West Missouri Power Company, whose headquarters are at Pleasant Hill, Mo., has applied to the Missouri Public Service Commission for permission to construct a hydro-electric dam and power plant on the Osage River at Osceola, Mo. The dam and power plant will cost approximately $356,900. Two 800-kw. generators will be installed. The energy will be supplied to the Ozark Utilities Company and the Missouri Public Service Company, both of which operate in western and southwestern Missouri. The operating expense annually will be $31,850 after the power plant is constructed.

Mobile's Municipal Electric Plans.—The City Commission of Mobile, Ala., has passed an ordinance authorizing the proposed "white ways" on a group of principal streets in the business district of Mobile as well as sections of several streets in residential territory, among them the historic Government Street. The cost, which will be distributed against the property benefited, is estimated at $200,000. Harry T. Hartwell, waterworks commissioner, has begun an investigation into the economic advisability of constructing a municipal electric plant at Mobile the primary function of which would be to furnish power for operating the waterworks system.

North Central Association Will Hold Group Conferences Again This Year.—The executive committee of the North Central Division, N.E.L.A., has again approved group conferences instead of a general convention of this association, last year's experience having proved encouraging to this plan. An accounting conference will be held on Oct. 19-20, an engineering meeting on Jan. 21-22, 1929, and a commercial sales meeting on Feb. 25-26, all at the Nicollet Hotel in Minneapolis. It has been decided, however, to hold a convention in 1929 and every two years thereafter.

More Power from Raquette River, N. Y.—The St. Lawrence Valley Power Corporation of Potsdam, N. Y., is installing additional generating equipment at its Colton hydro-electric plant which will bring the potential capacity of that plant to 38,000 hp. It is the largest of the company's chain of developments on the Raquette River. The new equipment consists of a 16,000-hp. unit—General Electric generator and Morris waterwheel—and will be an addition to two 11,000-hp. units now in the plant. Installation is expected to be completed early in November.

Two Black River Hydro Projects at Watertown, N. Y.—Two new hydro-electric power developments within the city of Watertown, N. Y., which will be among the largest on the Black River, are under consideration. The sites awaiting development are owned by the Factory Square Power Association and the Beebe Island Power Association. One power plant would be built below Factory Street bridge and the second at the lower end of Beebe Island. Under the plan all of the power would be developed and pooled at one plant.

Pacific Gas & Electric's Mokelumne Project.—The Pacific Gas & Electric Company has applied to the California Railroad Commission for authority to begin the construction of a comprehensive project of hydro-electric development on the North Fork of the Mokelumne River and its tributaries, contemplating the utilization of the flow of the North Fork, as regulated by existing and proposed storage reservoirs, through the head to the tailwater elevation of applicant's existing Electra power plant. It is the company's plan to construct a chain of four or more hydro-electric power plants having a total installed capacity of 147,000 kva.

Delegates to International Illumination Congress See Lighting Spectacle at Niagara Falls.—Searchlamps of nearly 2,000,000,000 cp. brought the legend of the "Indian Maid of the White Canoe" before the eyes of thousands of spectators at Niagara Falls two weeks ago when the foreign delegates to the International Illumination Congress were there. W. D'Arcy Ryan, director of the illuminating engineering laboratory of the General Electric Company, used a searchlamp of

60,000,000 cp. intensified nine times to project from a plate against the mist of the Horseshoe Falls an image of the maiden poised in a canoe laden with fruit. A battery of 24 searchlights rated at 60,000,000 cp. each was used as auxiliary equipment.

DELAWARE & LACKAWANNA ELECTRIFICATION.—Direct current of 3,000 volts will be used, according to an announcement this week, by the Delaware, Lackawanna & Western Railroad for propelling suburban trains on the 173 miles of track it will electrify in the northern New Jersey zone. This system is deemed the best suited to meet operating requirements applying in both suburban and main-line service, in the event that later it may be thought desirable to carry the electrification of the road over the Pocono Mountains to Scranton and the anthracite coal fields. Another detail will be the installation of mercury-arc rectifiers in connection with the application of power to the trains.

GENERATING STATIONS IN THREE LARGE NEW JERSEY CITIES ABANDONED.—Three more old-time generating stations of the Public Service Electric & Gas Company in New Jersey have bowed their way out of the modern picture and are being dismantled. They are respectively at Paterson, Camden and Trenton. With the abandonment of these three stations, only five generating stations—Kearny, Essex, Marion, Perth Amboy and Burlington—remain in active operation, with Cranford as a standby. Camden and Paterson are still being continued as substations. In December, 1903, the year in which the Public Service Corporation of New Jersey was organized, 28 generating stations were in operation with a total capacity of 40,075 kva., while the five stations in active operation today have a capacity of 607,526 kva.

FLORIDA POWER & LIGHT REPORTS ON STORM DAMAGE.—S. R. Inch, president of the Florida Power & Light Company, reported to the American Power & Light Company last week on the damage suffered by that system from the hurricane, his report, which followed an inspection of the storm area from Miami to Fort Pierce, being issued too late to be included in the ELECTRICAL WORLD's account of the storm's effects. Mr. Inch said that probably 85 per cent of the distribution poles in West Palm Beach, where the disturbance was especially violent, were standing, but that the wires were generally in bad shape and that complete repairs would probably take thirty days. Power-plant damage at West Palm Beach was light except for the destruction of a garage. At Palm Beach the damage to lines was surprisingly small, as was the damage in Okeechobee, Sanford and other places. Service in these towns was quickly resumed. The transmission line from Sanford to Stuart was also rapidly restored to service. The company's Diesel-engine plant at Pahokee was not badly damaged.

EUGENE, ORE., DEFENDS PRIVATE OWNERSHIP.—Although it is the most extensive operator of publicly owned utilities in the State of Oregon, the city of Eugene has assumed the leading rôle in a campaign to defeat the four initiated water measures which, should any one of them be adopted, would virtually authorize the state to maintain sole public ownership jurisdiction over the waters of four of the commonwealth's principal power streams. The Eugene municipal authorities have appointed a special committee of citizens to wage this contest, and the representatives of 51 civic organizations throughout the state met in Portland on Sept. 12 and assisted in the formulation of definite plans for opposing the bills. Operators of privately owned utilities have so far refrained from taking any active part in the campaign, despite the charges that they are mainly responsible for the introduction of the water-power legislation.

Coming Meetings

[A complete directory of electrical associations, with their secretaries, is published in the first issue of every volume. For latest list see issue for July 7, page 48.]

American Society of Mechanical Engineers—Boston, Oct. 1-3. C. W. Rice, 29 West 39th St., New York.

Association of Edison Illuminating Companies—Chamberlin-Vanderbilt Hotel, Old Point Comfort, Va., Oct. 1 to 5. P. S. Millar, East End Ave. and 80th St., New York.

National Safety Council—Hotel Pennsylvania, New York, Oct. 2-5. W. H. Cameron, 108 East Ohio Street, Chicago.

Southern Appalachian Power Conference—Atlanta, Oct. 8-10. W. A. Nelson, Charlottesville, Va.

American Welding Society—Philadelphia, Oct. 8-13. M. M. Kelly, 33 West 39th St., New York.

Eastern Association of Electrical Inspectors—Municipal Bldg., Springfield, Mass., Oct. 10-11. R. Walker, 85 John St., New York.

Kansas Section, N.E.L.A. — Wichita, Kan., Oct. 18-19. H. Lee Jones, 401 National Reserve Bldg., Topeka.

American Engineering Council—Administrative board, Pittsburgh, Oct. 19-20. L. W. Wallace, 26 Jackson Place, Washington, D. C.

International Association of Municipal Electricians—Hotel Montelson, New Orleans, Oct. 22-26. H. N. Lang, Box 1864, Orlando, Fla.

Public Utilities Association of West Virginia—Hotel Pritchard, Huntington, Oct. 24-25. A Bliss McCrum, 514 Charleston National Bank Bldg., Charleston.

American Institute of Electrical Engineers — Regional meeting, Atlanta, Oct. 29-31. F. L. Hutchinson, 33 West 39th St., New York.

National Electrical Manufacturers' Association—Briarcliff Lodge, Briarcliff, N. Y., Oct. 29-Nov. 1. S. N. Clarkson, 420 Lexington Ave., New York.

Electrical Credit Association—Middle and Southern Atlantic States Division, Philadelphia, Nov. 1; J. W. Crum, 1211 Arch St., Philadelphia. Central Division, Chicago, Nov. 15-16; F. P. Vose, 1008 Marquette Bldg., Chicago. New York Division, New York, Dec. 17; W. J. Kreger, 261 Broadway, New York.

National Electrical Wholesalers' Association—Chicago, Nov. 12-16. E. Donald Tolles, 165 Broadway, New York.

National Association of Railroad and Utilities Commissioners — New Orleans, Nov. 13-16. J. B. Walker, 270 Madison Ave., New York.

Public Utilities Association of Virginia—Hotel Roanoke, Roanoke, Va., Nov. 21-22. A. B. Tunis, 301 East Grace St., Richmond, Va.

Commission Rulings

DAM RECONSTRUCTION ON BOUNDARY STREAM AND INTERSTATE HYDRO SERVICE.—The findings of the New Hampshire Public Service Commission on the application of the Bellows Falls Canal Company of Vermont some time ago for permission to reconstruct its dam across the Connecticut River between the town of Walpole, in New Hampshire, and the village of Bellows Falls, in Vermont, the reconstructed dam to be 11 ft. higher than the present dam, have just been printed in *Public Utilities Reports*. This case led to protracted hearings on account of its interstate nature, the power being generated wholly in Vermont. The New Hampshire commission held that: (1) The reconstruction of a dam to an increased capacity for the production of additional energy which is to be delivered beyond the state borders is not for the "public use and benefit" within the meaning of an act providing for such reconstruction where the Public Service Commission shall find the same to be for "public use and benefit," unless the state reserves jurisdiction over the total amount of power developed, for the purpose of protecting the local state demand, and unless there is demand for some additional consumption within the state. (2) A public service law giving the state commission control over the exportation of hydro-electric energy beyond the state boundary has no application to a case where a dam is constructed on a river within the state but the power is generated beyond the state limits. (3) Reconstruction of the dam for increased capacity is approved since the petitioner, a foreign corporation, stipulates that it will submit to the jurisdiction of the local commission as to the amount of electricity generated in the adjoining state by the water diverted within this state which shall be delivered to the local public and the terms upon which it shall be furnished.

Recent Court Decisions

VIOLENT FLUCTUATIONS IN VOLUME OF WATER IN STORAGE RESERVOIR FORBIDDEN.—The Supreme Court of New York at Syracuse has granted an injunction asked by Fred W. Hammond and others against the Antwerp Light & Power Company and Joseph Baumert. The plaintiffs, cottage and property owners at Lake Bonaparte in the Adirondacks, alleged that the defendants during the high-water season impounded water so that plaintiffs' properties were flooded and during droughts lowered the water so that plaintiffs' boathouses were high and dry. The Antwerp Light & Power Company has two plants on the Indian River and owns and controls a site near Alpine, on the Bonaparte River, which flows into the Indian River. Mr. Baumert had owned and controlled a dam at this site from 1904 until 1910, when the light and power company was organized. A dam regulating the flow of water was in operation during that time. In 1920 the power company built below the old dam a second dam with a higher crest. The court order forbade impounding the water above the level of the new dam or lowering it more than 12 inches below that level.

News About Men of the Industry

H. B. Bryans Appointed to New Executive Position

Henry B. Bryans, for the past year general superintendent in charge of engineering of the Philadelphia Suburban-Counties Gas & Electric Company, has recently been appointed assistant general manager of the Philadelphia Electric Company. Mr. Bryans brings to his new position a broad background of general engineering practice and operation in the state of Pennsylvania, including connections with the Fulton County Gas & Electric Company, the United Gas Improvement Company and the Counties Gas & Electric Company. He has been most diligent in the committee work of the National Electric Light Association, the Pennsylvania Electric Association, the American Institute of Electrical Engineers and he holds membership in the American Society of Mechanical Engineers, the American Gas Association and other similar organizations.

H. B. Bryans

EDWARD J. MEHREN, vice-president and editorial director of the McGraw-Hill Publishing Company, has been appointed editor of the *Magazine of Business*, which recently came under McGraw-Hill control through the consolidation of that organization and the A. W. Shaw Company of Chicago. The *Magazine of Business* is published for the leaders in every branch of American business and treats of those major developments that affect business in general, banking and finance, manufacturing and production, sales and distribution and in the servicing fields, such as transportation, communication and electric light and power. The editorship of such a paper requires some one with a broad experience in business and a thorough knowledge of editorial and publishing practice. It is for these reasons that Mr. Mehren, who has been with the McGraw-Hill organization for 21 years, was selected for the editorship. Mr. Mehren began his publishing career as an associate editor on *Engineering Record*. Subsequently he became editor of *Engineering Record* and of *Engineering News-Record*. For the last five years he has been vice-president and editorial director of the McGraw-Hill Publishing Company, in charge of the editorial activities of the organization. He has a wide acquaintance throughout business and is noted for his writing and addresses on engineering, industrial and business topics. Mr. Mehren will continue as vice-president and editorial director of the McGraw-Hill Company.

P. J. Morrissey in New York

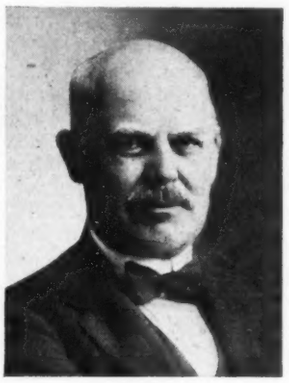
P. J. Morrissey, formerly vice-president of the Pennsylvania Electric Company, Johnstown, Pa., has been transferred to New York as vice-president of the Consumers Construction Company, which supervises construction engineering services for the Associated System. Mr. Morrissey, who is one of the pioneers in the development of the Pennsylvania properties and who has been instrumental to a large degree in the building up of the Pennsylvania group, took up his duties in New York Sept. 1. His early experience following graduation from Pennsylvania State College was with the Detroit Edison Company. In 1911 he affiliated himself with the electrical properties in Johnstown as general manager of the Citizens' Light, Heat & Power Company of Pennsylvania. When that utility and several affiliated companies were merged to form the Penn Public Service Corporation Mr. Morrissey became vice-president. He is active in the Pennsylvania Electric Association, being a past-president.

GEORGE R. KERR has been appointed vice-president and treasurer of the Canadian Westinghouse Company. Mr. Kerr was one of the original members of the Westinghouse Manufacturing Company, Ltd. When the Canadian Westinghouse Company was organized in 1903 Mr. Kerr was placed in charge of the accounting end of the business and has been identified with the remarkable progress made by this company since its inception. His appointment as treasurer dates back ten years.

JUDGE T. J. BROWN, chairman of the Missouri Public Service Commission, has resigned, effective Oct. 1, and will be succeeded as chairman by Judge Almon Ing, who has been on the commission since early in 1925. Judge Brown's place on the board will be filled by J. Perry Painter, now assistant general counsel of the commission and formerly its secretary. Judge Brown, who was appointed a member of the commission by Governor Hyde in July, 1923, will practice law in Jefferson City.

Dr. Acheson Donor of Electrochemical Award

Dr. Edward Goodrich Acheson, who has recently presented to the American Electrochemical Society $25,000 as a trust fund to form the basis of an award every second year of a gold medal and a prize of $1,000 for a distinguished contribution to any of the branches fostered by the American Electrochemical Society, is well known for his numerous inventions. In 1880 he entered the employ of Thomas A. Edison at Menlo Park, N. J., his first position being that of assistant draftsman under John Kruesi (father of the present president of the American Electrochemical Society). In July, 1881, Dr. Acheson was sent as first assistant engineer of the Edison interests to the Electrical Exposition in Paris. He returned to the United States in 1884 and for a time was connected with the Consolidated Lamp Company of Brooklyn and the Standard Underground Cable Company of Pittsburgh. The spirit of experiment was strong with him and electrical and chemical problems engaged his spare hours. Early in 1891 Dr. Acheson produced in the electric furnace the first sample of carborundum, the well-known abrasive and refractory now used all over the world. The invention of carborundum has been of great benefit to many industries, cheapening the production of numerous articles and improving the finish of many others. Not long after the invention of carborundum Dr. Acheson produced the first large sample of artificial graphite, the applications of which number a thousand and one.



E. G. Acheson

JOHNS HOPKINS, assistant secretary of the United Gas Improvement Company, has been promoted to the position of secretary of the company to succeed George W. Curran, resigned. Mr. Hopkins started his public utility career in the accounting department of the American Gas Company thirteen years ago.

B. H. Gardner to Direct Sales of Columbia Organization

B. H. Gardner has been appointed director of sales of the Columbia Engineering & Management Corporation. Mr. Gardner will supervise and co-ordinate the new-business activities, both gas and electric, of Columbia System properties, in co-operation with the executives and commercial departments of the various companies. His headquarters will be in the Columbia offices at Columbus, Ohio. Mr. Gardner, who will assume his new duties Oct. 1, has had wide experience in the utility business, his first connection having been with the Dayton Power & Light Company, one of the subsidiaries of the present Columbia System. He was with the Dayton company from 1906 to 1912, being in the sales end of the business most of that time. For nine years he was with the Connecticut Light & Power Company with headquarters at Waterbury. With that company he had charge of all sales and advertising and served for several years as local manager of some of their properties. For the past seven years he has been connected with the Northern Indiana Public Service Company, for three years as manager at Lafayette and for the past four years as assistant to the vice-president at the main office at Hammond, Ind. Mr. Gardner has served on various committees of the N.E.L.A. and the A.G.A.

H. U. HART has been appointed vice-president and chief engineer of the Canadian Westinghouse Company. In 1893 Mr. Hart enrolled as a student-apprentice of the Westinghouse Electric & Manufacturing Company at Pittsburgh. His advancement in the different branches of the works and engineering department was rapid, and in 1899 he was sent to the French Westinghouse Company as designing electrical engineer, and was later appointed as chief engineer. During this period Mr. Hart had charge of the design of some very large generators then being built for water-power developments in France and Italy. In 1905 he was secured by the Canadian Westinghouse Company as chief engineer.

O. F. HAAS has been appointed assistant general manager of the Atlantic-Federal Division at New York City of the National Lamp Works of the General Electric Company. This appointment becomes effective Oct. 1. Mr. Haas removed to Nela Park following graduation from the University of Illinois in 1918 and has since worked with Ward Harrison, director of illuminating engineering. He became interested in street lighting activities and today is internationally recognized as one of the foremost authorities on this subject. Two of the best lighted streets in the world, State Street, Chicago, and Superior Avenue, Cleveland, are, in part, the result of Mr. Haas' efforts. He was also instrumental in floodlighting the new Ohio Bell Telephone Company in Cleveland. When the United States government began working on a transcontinental airway system Mr. Haas offered many lighting suggestions, for which he was cited by the United States Post Office Department.

W. D. Johnston Heads Rocky Mountain Division

W. D. Johnston, who was elected president of the Rocky Mountain division of the National Electric Light Association, as announced in the Sept. 22 issue of the ELECTRICAL WORLD, has been identified with the electrical industry in the West for almost twenty years. In 1909 he became associated with the Nunn interests in the operation of the Telluride Power Company of Utah. Three years later he was awarded a

W. D. Johnston

scholarship by the Telluride association, the educational foundation established by L. L. Nunn in connection with Cornell University, and in 1917 he was graduated with the degrees of A.B. and M.E. Following graduation he spent three years with the Bell Telephone Company of Pennsylvania in the capacity of designing and power engineer. In 1920 he was appointed general superintendent of the Natrona Power Company at Casper, Wyo., a Nunn subsidiary, under the direction of E. P. Bacon, whom he succeeded when the company was sold to the Byllesby interests, and Mr. Bacon formed another company. Mr. Johnston is now division manager of the Mountain States Power Company, Casper, Wyo.

GEORGE A. COOPER of the Monongahela West Penn Public Service Company, Fairmont, W. Va., has been appointed an assistant chief business specialist in the division of simplified practice of the Bureau of Standards, U. S. Department of Commerce. Prior to affiliating himself with the division of simplified practice Mr. Cooper was superintendent of materials of the Monongahela West Penn Public Service Company. He has had considerable experience in the actual application of simplified practice within a company.

C. C. Christ Assumes New Duties

Clarence C. Christ has been made vice-president of the General Public Utilities Company, the subsidiaries of which are owned by the American Community Power Company, operating out of St. Louis. Mr. Christ started his public utility career with the Citizens' Traction Company in Oil City, Pa. In 1920 he was transferred to Day & Zimmermann, Inc., Philadelphia, who at that time operated the Citizens' Traction Company. In this new connection Mr. Christ had charge of the merchandise divisions of all Day & Zimmermann properties, and later was given charge of the new-business activities and the rate structures of all of the light and power properties operated by Day & Zimmermann. With the sale of the General Public Utilities Company to the American Community Power Company Mr. Christ became vice-president.

ALEXANDER H. KRIDEN has been elected a director of the Burke Electric Company, Erie, Pa.

R. A. HAIGH, sales manager of the Pawtucket division of the Blackstone Valley Gas & Electric Company and the Pawtucket Gas Company, has resigned. Mr. Haigh is removing to Detroit to engage in the securities business.

Obituary

GEORGE J. WELLS, chief electrical inspector for the Electrical Bureau, Philadelphia, died suddenly in Atlantic City Sept. 8. Mr. Wells was prominent in engineering circles in the Quaker City.

ROBERT E. BROWN, for 41 years manager of the Mankato (Minn.) division of the Northern States Power Company, died June 27, after an illness of several months. He took charge of the local gas company in 1887 and when the local electric service was purchased, two years later, he was made manager. In 1910 the property was purchased by H. M. Byllesby & Company and Mr. Brown was retained.

WALTER N. GORDANIER, superintendent of the Electron generating station of the Puget Sound Power & Light Company, died Aug. 25. A native of Ontario, Canada, Mr. Gordanier received his technical training at the Queens University. He had obtained some experience with the General Electric Company at Petersboro, Canada, on transformer and motor testing during his vacation periods. Removing west to British Columbia upon the completion of his college course, he entered the employ of the Columbia Improvement Company at Electron. It was in 1912 that he became superintendent of the station, the position he held at the time of his death.

Financial and Statistical News

Stocks Turn Upward in Heavy Trading

Several Issues Near Previous High Levels—Effect of High Money Rates on General Business

POWER and light stocks moved definitely upward again this week. Several point gains are recorded in a number of issues and practically the entire list of actively traded common stocks are in higher ground than a week ago.

Electric Bond & Share Securities common has been unusually active, showing a gain of as much as 7⅛ points in a single day's trading and approaching the stock's previous high mark. The company has just announced an issue of rights to shareholders on a basis of one for three at $90.

Engineers Public Service was also in heavy demand, selling up close to its previous high of 46¼. Trading was active in the case of Commonwealth Power around 87-88 and Consolidated Gas of New York around 81-82.

EFFECT OF HIGHER MONEY RATES

Money rates, which constitute a topic of interest in the current financial markets, are discussed from an interesting viewpoint in the current quarterly review of Halsey, Stuart & Company. After discussing the increase in rates and the drop in volume of new financing, the review makes this comment as to the effect of higher money on business generally:

The significant—and encouraging—thing about all this, however, is that it reflects no basically unsound conditions in business and industry. In fact, it is a striking commentary on the strength and soundness of business generally that it has continued active in the face of the prevailing high money rates. Despite the handicap of high money, which, of course, adds to the cost of operation, business in most lines still continues at the active pace set earlier in the year.

July Customer Ownership Sales $7,901,000

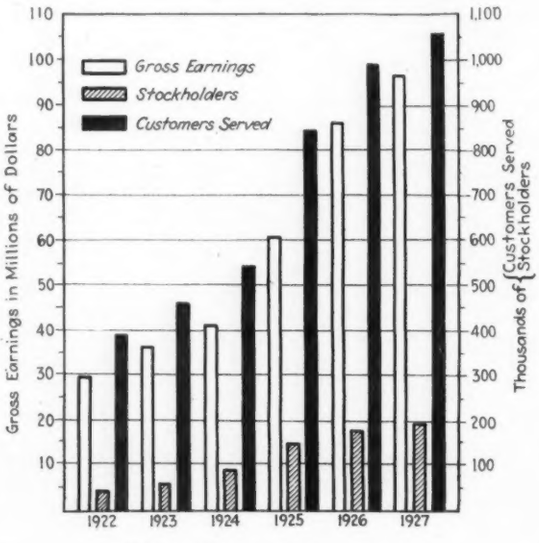
Sales of electric light and power company stock locally to customers and employees in July balanced the high figures for May and June by dropping to the smallest totals, slightly below those of February, thus far this year: 138,200 shares, valued at $7,901,000, sold in 10,950 transactions, according to reports from individual companies received by the ELECTRICAL WORLD. The average per transaction, $720, is within the usual range; the average price per share, $57, reflects the combined influence of $100 shares accounting for about seven-tenths of the money value and of shares sold at prices from $25 to $40 making up the remainder. The reports indicate, in general, a lack of activity; many companies made no sales whatever. But there are high individual exceptions, one company's sales exceeding $2,000,000. Four others had sales exceeding $500,000 and nine reported between $100,000 and $500,000 for the month's transactions.

Consumers Power Stockholders Offered Shares

Stockholders of the Consumers Power Company at the annual meeting held Aug. 7, 1928, authorized an increase of 250,000 shares without par or face value in the authorized preferred capital stock of the company. This preferred stock can be issued and sold only when authorized by the Michigan Public Utilities Commission for capital expenditures, including the acquisition of property, the construction, completion, extension or improvement of facilities or for the improvement or maintenance of service, made necessary by the growth of the company and the increased demands for service. A series of $5 cumulative preferred stock without par or face value, with dividends payable quarterly on the first days of January, April, July and October, entitled, upon dissolution, to $100 per share and accrued dividends and callable upon 60 days' notice at 105 and accrued dividends, has been created and all stockholders of the company have been offered an opportunity to purchase this stock at $95 per share and accrued dividends to date of payment. Subscriptions under this offer will be received up to and including Oct. 8, 1928, and may be paid in full or in installments, under this company's time payment plan of a down payment of $10 per share and the balance in monthly installments of $10 per share with a final payment of $5.

Middle West Utilities Extending Field of Operation

SIXTEEN years ago the Middle West Utilities Company was organized with the purpose of bringing electric service at a low cost to the small communities and countryside. A study of the growth of this Insull holding company proves beyond a doubt that this purpose is being fulfilled. With its subsidiary companies' systems extending over 19 states, 2,000 communities are at the present time deriving the industrial and domestic benefits resulting from electric service. In 1925 alone the total purchases for the year represented an addition of 543 communities to the system and in 1926 and again in 1928 substantial acquisitions were made in the Southwest and in New England. Gross earnings of the subsidiary companies for the year 1927, with earnings of the new properties included only from the dates of their acquisition, amounted to $96,659,078, an increase of 11.9 per cent over the year 1926. Net earnings totaled $35,878,095, representing an increase of $4,962,385, or 16.05 per cent, over the net earnings of the preceding fiscal period. The accompanying table shows the income account statement of the chief subsidiaries of the Middle West Utilities Company.



Middle West Utilities earnings show consistent growth

During the year the Middle West subsidiaries set aside appropriations from income of $4,120,360 for future retirements, renewals and replacements of physical properties. In addition $6,502,343 was expended during the year by the subsidiaries for ordinary repairs and maintenance of operating efficiency of their properties, making a total of $10,622,703 for depreciation and maintenance. This amount is 12.71 per cent of the $83,550,918 of gross operating earnings of the subsidiaries as shown in the analysis of gross earnings.

The generation, transmission and distribution of electrical energy for power, light and heat provided in the year 69

per cent of the gross operating earnings of the subsidiary operating companies. The increase in electric generation during the year 1927 represented almost altogether a growth within existing properties, as the acquisition of new properties was fewer than in preceding years. Steam and hydro generation were both greater, the total generation for the year being an increase of 18.9 per cent over that of 1926. Electrical output in 1927 amounted to 2,354,241,555 kw., as compared with 2,054,497,637 kw. in 1926. In 1922 the output totaled only 711,950,821 kw. A significant fact in this connection is that while the energy generated by steam plants increased 20.3 per cent in 1927, the fuel used increased only a little over 5 per cent, a considerable accomplishment in the way of operating economies.

Fuel consumption per kilowatt-hour of electricity generated was conspicuously lowered during the year 1927, the decrease being equivalent to one-third of a pound of coal per kilowatt-hour. This includes all steam plants, small as well as large. An increase of 20 per cent in kilowatt-hours generated by steam was realized in 1927 with a 5 per cent increase in fuel. As a result, the consumers profited because new domestic rate schedules were put into effect. Electric rates did not advance with other prices in the war period covering the years 1913 to 1918, but wartime conditions caused increases after 1918. The income per kilowatt-hour of electricity sold by subsidiaries of the Middle West Utilities Company rose after 1918, but began to decline again about 1922.

In 1925 the figure for residence and commercial service — comprising the great bulk of the company's customers —was practically back to the 1918 level, and the records for 1927 shows a further decline to a figure substantially below the residence and commercial rates in 1918. This means that for residence and commercial service the revenue per kilowatt-hour is now below the pre-war level despite the fact that prices of fuel, labor and other essentials are still emphatically higher. The power service cost per kilowatt-hour continued downward in 1927 in a similar manner.

The subsidiary companies were active in construction work during the year, adding to generating facilities, extending transmission lines and distribution systems and interconnecting transmission systems for greater economy and reliability of service. Expenditures for new construction during the year aggregated $47,379,887, an increase of $8,991,460 over the amount expended in 1926. Miles of transmission lines at the close of 1927 totaled 17,273, compared with 14,454 in 1926 and 11,432 in 1925.

The total number of stockholders of all subsidiaries of the Middle West Utilities Company at the close of the year was 155,386. During 1927 alone the subsidiary companies sold 216,899 shares of their prior lien and preferred stock. In addition, stock had been sold Dec. 31, 1927, to 5,807 subscribers on the partial-payment plan. In financing the extension of service, customer ownership continues to be an important phase of the subsidiaries' business.

Middle West Utilities Company

	1927	1926
Total income	$11,316,824	$9,663,087
Expenditures	1,273,392	1,106,138
Interest and taxes	424,927	325,460
Net income	9,618,506	8,231,489
Dividends (pf. and pr. ln.)	5,823,044	4,810,725
Proportion of subs. undistributed surplus	3,192,939	2,874,763
Combined surplus earnings	6,988,401	6,295,526
Dividends on common	2,272,014	2,046,666
Balance	4,716,387	4,248,860

Central & South West Utilities Company
(Consolidated Income Account)

Gross revenues	$28,047,641	$23,763,366
Operating expenses and taxes	16,891,338	14,591,964
Retirement	1,364,403	1,061,779
Operating income	9,791,900	8,109,623
Fixed charges (subs.)	2,832,405	2,397,360
Discount amortization	533,424	480,529
Minority interest	2,390,288	1,606,212
Balance accruing	4,035,783	3,625,522

Central Illinois Public Service Company
(Consolidated Income Account)

Gross earnings	$13,444,713	$12,744,077
Operating expenses and taxes	8,251,008	8,137,157
Net earnings	5,193,705	4,606,920
Fixed charges	2,229,849	2,055,762
Balance	2,963,856	2,551,158
Depreciation	416,337	399,112
Net income	2,497,519	2,152,046
Dividends	2,308,309	1,988,047
Surplus	189,210	163,999

Central Power Company

Gross revenue	$1,124,725	$924,396
Operating expenses and taxes	736,159	643,907
Retirement	39,513	11,063
Net revenues	349,053	269,426
Fixed charges	151,776	140,652
Interest, rentals, federal taxes	50,702	20,282
Balance	146,575	108,492
Preferred dividends	70,536	59,142
Surplus	76,039	49,350

Illinois Northern Utilities Company

Gross earnings	$3,302,500	$3,078,753
Operating expenses, taxes, etc.	1,705,186	1,656,990
Rentals	41,950	41,979
Net earnings	1,555,364	1,379,784
Fixed charges	488,407	437,142
Balance	1,066,957	942,642
Depreciation	160,144	113,903
Balance for dividends	906,813	828,739
Dividends	639,998	621,939
Surplus	266,815	206,800

Indiana Hydro-Electric Power Company

Gross earnings	$572,034	$494,354
Operating expenses and taxes	158,621	138,375
Net income	413,413	355,979
Other income	4,479	577
Total income	417,892	356,556
Interest, debt discount, retirement reserve, etc.	222,281	231,363
Balance available for dividends	195,611	125,193
Preferred dividends	138,372	123,216
Surplus	57,239	1,977

Interstate Public Service Company

Operating revenue	$9,991,303	$9,721,901
Operating expenses and taxes	6,456,508	6,328,235
Net income	3,534,795	3,393,666
Other income	29,074	28,707

Interstate Public Service Company (Continued)

Total income	3,563,869	3,422,373
Balance for interest, etc.	3,398,985	3,257,158
Bond interest, etc.	1,603,765	1,477,582
Balance	1,795,220	1,779,576
Depreciation	253,137	281,651
Balance for dividends	1,542,083	1,497,925
Dividends	1,408,873	1,373,700
Surplus	133,210	124,225

Kentucky Utilities Company
(Consolidated Income Account)

Gross revenues	$5,942,432	$5,119,766
Operating expenses, taxes and depreciation	3,778,060	3,213,444
Net operating revenues	2,164,372	1,906,322
Other income	401,740	457,742
Total income	2,566,112	2,364,064
Fixed charges	1,059,423	1,038,707
Net income	1,506,689	1,325,357
Dividends	1,408,761	1,233,241
Surplus	97,928	92,116

Michigan Gas & Electric Company

Gross earnings	$1,148,308	$1,027,021
Operating expenses and taxes	738,916	702,514
Retirement	44,736	28,766
Net income	364,656	295,741
Fixed charges, etc	171,223	152,200
Balance	193,433	143,541
Dividends	179,809	120,193
Surplus	13,624	23,348

Missouri Gas & Electric Service Company

Operating revenues	$633,484	$616,048
Operating expenses, depreciation and taxes	478,182	475,023
Net operating income	155,302	141,025
Non-operating income	1,605	1,784
Total income	156,907	142,809
Interest	84,853	73,156
Amortization, etc.	5,004	4,932
Balance	67,050	64,721
Dividends	54,498	54,261
Surplus	12,552	10,460

North West Utilities Company

Gross earnings	$1,041,294	$916,810
Administration expenses	43,896	45,951
Net earnings	997,398	870,859
Fixed charges		2,250
Balance	997,398	868,609
Dividends	916,237	756,646
Surplus	81,161	111,963

National Electric Power Company
(Consolidated Income Account)

Gross earnings	$18,088,731	$17,251,682
Operating expenses, taxes, depreciation, etc.	11,243,917	10,735,290
Net earnings	6,844,814	6,516,392
Fixed charges	4,787,077	4,514,953
Balance for dividends	2,057,737	2,001,439
Dividends	1,828,285	793,904
Surplus	229,452	1,207,535

United Utilities Company

Gross revenue	$146,266	$130,733
Operating expenses and taxes	93,200	84,370
Net revenues	53,066	46,363
Other income	35,402	36,614
Total income	88,468	82,977
Fixed charges	23,700	23,700
Depreciation	7,872	5,188
Net income	56,896	54,089
Dividends	44,627	44,790
Surplus	12,269	9,299

NEW SUBSIDIARY ORGANIZED IN UNITED MERGER.—The entire holdings of the Koppers interests in the preferred and common stocks of the American Light & Traction Company have been transferred to the United American Company, a newly organized subsidiary of the system, in return for $26,872,970 of United American twenty-year 5 per cent debentures and 150,000 shares of class A common stock of the United Light & Power Company. In the system's structure United American is a subsidiary of the United Light & Railways Company of Delaware, a subsidiary of the United Light & Power Company. The American Light & Traction Company, through stocks held by United Light & Railways prior to this transaction and through the additional stocks transferred to United American, is, therefore, an indirect subsidiary of United Light & Power.

FINANCE COMMITTEE FORMED BY STANDARD GAS.—At the regular meeting of the board of directors of the Standard Gas & Electric Company there was created a finance committee, to have supervision over all financial affairs of the company. This committee consists of B. W. Lynch, chairman; R. J. Graf, J. H. Briggs and M. A. Morrison, all of whom are vice-presidents of the company. At the same meeting the Standard Gas & Electric Company declared a dividend of $1.75 a share quarterly on the 7 per cent prior preference stock and 87½ cents a share on the common stock, both payable Oct. 25 to stockholders of record Sept. 30.

Utility Earnings Reports Continue Favorable

	1928	1927	Per Cent Increase	Operating Ratio 1928	Operating Ratio 1927
American Water Works & Electric and subs. (Year ended July 31)					
Gross earnings	$49,994,367	$47,551,693	5.1	52	52
Net earnings	23,856,814	22,935,774	4.0	..	..
Cities Service (Year ended July 31)					
Gross earnings	33,267,230	30,078,734	10.6	..	..
Net earnings	32,136,624	28,995,833	10.9	..	..
Detroit Edison and subs. (7 months ended July 31)					
Gross earnings	29,796,886	27,287,204	9.2	66	69
Net earnings	10,177,678	8,432,145	20.7	..	..
Illinois Power & Light and subs. (Year ended June 30)					
Gross earnings	$32,557,685	$31,647,011	2.9	59	60
Net earnings	13,429,261	12,497,174	7.5	..	..
New Orleans Public Service (Year ended June 30)					
Gross earnings	18,594,325	18,027,258	3.2	62	63
Net earnings	7,131,773	6,690,817	6.6	..	..
United Light & Power and subs. (Year ended June 30)					
Gross earnings	45,434,721	41,537,329	9.4	58	59
Net earnings	19,260,226	17,225,487	11.8	..	..
Virginia Electric & Power and subs. (Year ended July 31)					
Gross earnings	15,871,939	15,146,487	4.8	58	60
Net earnings	6,638,628	6,089,747	9.0	..	..

New Preferred Stock Issues Appear

During the last week of September the Rochester Central Power Corporation made an offering of 6 per cent cumulative preferred stock to the amount of $8,000,000, the price being 97 and accrued dividend. It will be recalled that this new holding company issued the preceding week 5 per cent gold debentures, totaling $22,500,000. The proceeds from the sale of these debentures, together with $18,000,000 of preferred stock (of which this offering is a part, the balance having been exchanged, or underwritten for distribution in the territory served), and 1,600,000 shares of common stock will be used for the acquisition of all the common stocks of the companies to be owned by the Rochester Central Power Corporation.

The United Public Utilities Company issued 15,000 shares of $6 dividend series preferred stock without par value at $91.50 per share and accrued dividends, yielding over 6.55 per cent. This company owns all of the outstanding bonds, indebtedness (except current indebtedness not in excess of current assets) and at least 95 per cent of the capital stock of operating subsidiaries furnishing public utility service to a group of communities in the territory lying between Dayton, Ohio, and Winchester, Ind., in North and South Dakota and in Alabama, Texas, Arkansas and Louisiana.

With the purpose of acquiring additional interests in certain electric light and power companies and for other corporate purposes, the American Superpower Corporation issued 60,000 shares of first preferred stock at $99½ a share and accrued dividends, to yield over 6 per cent.

Three foreign issues appeared among the new offerings. The five-million-dollar issue of $6 cumulative first preferred shares of the Foreign Light & Power Company was priced at $100 per share, to yield 6 per cent. Each cumulative first preferred share was accompanied by one common share. Of this total $3,000,000 has been sold abroad by the Union Bank of Switzerland. The second foreign loan was raised by the Rhine-Westphalia Electric Power Corporation in the form of consolidated mortgage gold bonds, totaling $20,000,000. The Gatineau Power Company made an offering of 6 per cent gold debentures, totaling $7,500,000, the price being 101 and accrued interest to yield over 5.88 per cent.

Among the new bond offerings was an issue of first mortgage 5 per cent gold bonds of the Green Mountain Power Corporation priced at 96½ and accrued interest, to yield about 5.27 per cent, a piece of financing involving $7,200,000. The Green Mountain Power Corporation now owns and presently will own properties in the north central part of Vermont.

The Memphis Power & Light Company made an offering of first and refunding mortgage gold bonds, amounting to $3,000,000 at 93 and accrued interest, to yield about 4⅞ per cent.

ELECTRIC BOND & SHARE SECURITIES TO ISSUE STOCK.—Directors of the Electric Bond & Share Securities Corporation have voted to offer to holders of its common stock of record of Oct. 4 one additional share at $90 for each three shares then held. This will mean the issuance of 801,275 shares. Warrants for the new shares will expire on Oct. 31.

Foreign Companies Borrow Extensively in United States

Foreign public utility corporations borrowed in the American market from the beginning of 1924 to the end of 1927 a total par value of $722,925,000 in publicly offered securities, or about 20 per cent of the total corporate financing done in this market during that period. These figures were contained in a study recently made by the finance and investment division of the Department of Commerce.

The accompanying table compiled by the ELECTRICAL WORLD shows the extent to which electric light and power and electrical manufacturing companies borrowed in the American market during the first nine months of 1928.

Foreign Electrical Financing in 1928

Name of Company	Issue	Amount	Price
Canada			
Saguenay Electric Company	First and collateral trust, 5½s, A, 1953	$1,360,000	98½
International Power & Paper Company	First mortgage, 5s, 1968	4,866,000	100
Abitibi Power & Paper Company	Cumulative preferred stock, 6%	16,000,000	102
	Cumulative preferred stock, 6%	10,000,000	102
Nova Scotia Light & Power Company	First mortgage 5s, A, 1953	50,000,000	94½
	First mortgage 5s, A, 1958	3,500,000	99½
Shawinigan Water & Power Company	First and collateral trust, 4½s, B, 1968	10,000,000	98½
Gatineau Power Company	Gold debentures, 6%	7,500,000	101
Germany			
Westphalia United Electric Power Corporation	First mortgage, 6s, A, 1953	20,000,000	92¾
Municipal Gas & Electric Company of Brecklinghausen	First mortgage, 7s, 1947	1,500,000	98
Electric Power Corporation	First mortgage, 6½s, 1953	5,000,000	99½
General Electric Company	Debentures, 6s, 1948	10,000,000	94½
	Debentures, 6s, 1948	5,000,000	95
Pomerania Electric Company	Mortgage, 6s, 1953	3,500,000	92½
Unterelbe Power & Light Company	Mortgage, 6s, A, 1953	5,000,000	93
Brandenburg Electric Power Company	First mortgage, 6s, 1953	5,000,000	93½
East Prussian Power Company	First mortgage, 6s, 1953	3,500,000	91
Gesfürel	Debentures, 6s, 1953	5,000,000	100
Luneburg Power, Light & Waterworks	First mortgage, 7s, 1948	1,100,000	98
Rhine-Westphalia Electric Power Corporation	Cons'd mortgage gold bonds, 6s, 1928	20,000,000	94
Italy			
Italian Superpower Corporation	Debentures, 6s, 1963	20,250,000	100
Terni-Societa per l'Industria e l'Elettricità	First mortgage, 6½s, A, 1953	12,000,000	90¼
Lombard Electric Company	First mortgage, 7s, A, 1952	4,000,000	96
Piedmont Hydro-Electric Company	Gold notes, 5½s, 1929	4,000,000	99¾
Norway			
Oslo Gas & Electricity Works	Gold bonds, 5s, 1963	6,000,000	95¼
Switzerland			
Swiss-American Electric Company	Cumulative preferred stock, $6	9,850,000	98½
Foreign Light & Power Company	Cumulative first preferred, $6	5,000,000	100
Japan			
Nippon Electric Power Company	First mortgage, 6½s, 1953	9,000,000	94
Tokyo Electric Light Company	First mortgage, 6s, 1953	70,000,000	90¼

Business News and Market Conditions

Operations Continue on High Plane

Production in Electrical Manufacturing Plants Holding Well Above Last Year—Eight Months Production 5.1 per Cent Over Same Period in 1927

DURING August the electrical manufacturing plants of the nation reported that productive operations were about 1 per cent under July, but were about 8.5 per cent over August last year. The operations of the electrical manufacturing plants have been materially above those of last year ever since January, the average rate of operations during the first eight months of the current year being about 5.1 per cent over the same period in 1927. Past history would indicate that September should witness a materially increased rate of operations in these plants. Last year this increase during September was 14 per cent as compared with August, but by reason of the high rate of operations which has been maintained during the current summer it is doubtful if any such rate of increase will be reported for the current September.

The index of activity in the electrical manufacturing industry based on the consumption of electrical energy stands at 119.4 in August, as compared with 120.8 in July and 110.2 in August, 1927. Comparative indexes of productive activity for the period 1923-25 as 100 and adjusted for number of working days are as follows:

August, 1928	119.4
July, 1928	120.8
June, 1928	118.9
May, 1928	120.1
August, 1927	110.2
Average first eight months 1928	121.2
Average first eight months 1927	115.3

The present production activities in the electrical manufacturing industry are following in a general way the productive operations of the nation's industries as a whole. The current summer has witnessed a rate of general manufacturing operations on an unusually high plane. August operations were about on a level with July, but were 7.6 per cent over the rate of operations witnessed during August, 1927. American industry as a whole has been operating on an unusually high plane ever since last March, and during this five months' period the rate of activity has not varied by more than 4 per cent, while during 1927 the productive activity during the same period varied by more than 10 per cent.

There has been practically no so-called "summer slump" in general industry during the current year, although one or two industries, such as textiles, have been witnessing comparatively low rates of activity in comparison with the operations in past years.

Westinghouse Head Foresees Expanding Business

While in Chicago recently inspecting the company's properties E. M. Herr of New York, president of the Westinghouse Electric & Manufacturing Company, voiced the opinion that the electrical industry has created more jobs than it has destroyed, despite the fact that much of the drudgery has been taken out of industry by replacing manual labor by electrically operated machines.

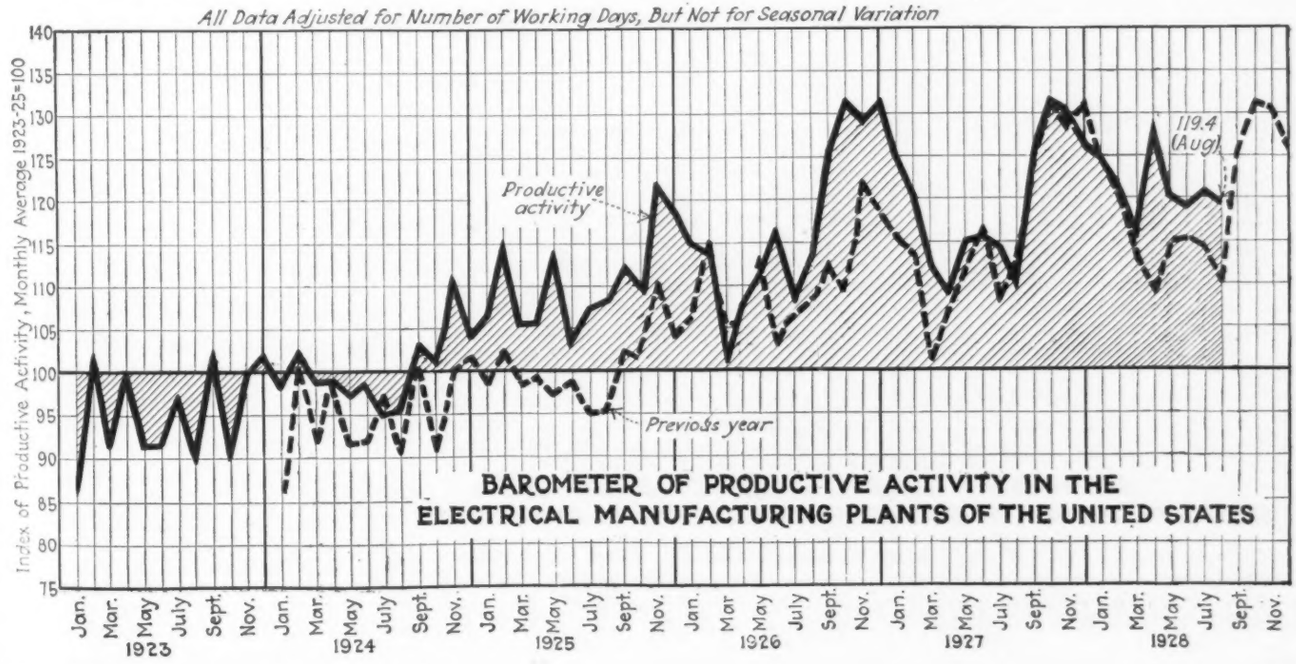
"Of the $500,000,000 per year gross business of the radio enterprise, as much as 45 per cent is spent on payrolls alone," he said. "Ten years ago there was no radio industry. Labor eliminated by automatic or remote control in the company's power stations is more than replaced by the numerous jobs created by the progress in the electrical industry."

Mr. Herr predicted that a substantial improvement in business is close at hand.

"Trade conditions are improving the country over, and from a careful analysis of underlying conditions that may be used as an index I feel like saying conditions are now much improved over what they were a year ago, and they will get better still," he declared.

Industry connected with public utilities is due for a continued growth and expansion, and this expansion, Mr. Herr stated, is founded on the sound basis of confidence that the public has in the industry. The eagerness with which the public invests its savings in the stock of the electric light and power companies shows this, he pointed out.

"The Westinghouse Electric & Manufacturing Company, in its plans for future expansion and development, has been influenced by the prospects," he said. "The electrical industry is developing in so many ways and has such far-reaching activities that it is difficult to understand its trend and future possibilities."



Market Conditions

AUTUMN business in the electrical equipment field is proving well up to expectations in all sections of the country, and is better than anticipated in a few districts. In the New England and Eastern areas orders both from utilities and from industrial concerns are large. In the Southeast the volume continues satisfactory, although no particularly large orders are recorded.

Farther west business is decidedly active and several large equipment orders are reported both from the St. Louis district and throughout the Middle West. On the Pacific Coast power companies are responsible for some very large orders, especially in turbines and transformers. One machinery order aggregates $280,000.

Copper Up Another ¼ Cent to 15¼—Zinc Quiet

Activity in copper and a further advance in the domestic market from 15 cents to 15¼ cents, Connecticut, has been the feature of the non-ferrous metal market the past week. Lead has continued in good demand at unchanged prices. Zinc was quiet with sellers firm at 6.25 cents, St. Louis, for all positions. Tin prices advanced slightly on better demand from speculative quarters. The activity in copper and lead is interpreted as reflecting keen demand for fabricated products on the part of ultimate consumers during the remainder of the year.

NEW YORK METAL MARKET PRICES

	Sept. 19, 1928 Cents per Pound	Sept. 26, 1928 Cents per Pound
Copper, electrolytic	15.00	15.025
Lead, Am. S. & R. price	6.50	6.50
Antimony	10.625	11.
Nickel, ingot	35.	35.
Zinc, spot	6.60	6.60
Tin, Straits	48.00	49.00
Aluminum, 99 per cent.	24.30	24.30

Base copper wire price Sept. 26, 1928, 17¼ cents.

New England Sales Advance in Certain Lines

An increase in certain lines of electrical equipment orders is noted in the New England district. An outstanding order was the placing of a contract for four 40,000-hp. water wheels operating under a head of 150 ft. at the first unit of the Fifteen-Mile Falls hydro-electric project on the upper Connecticut River. Negotiations are under way for a considerable amount of heavy power control equipment. Transformer sales increased and central-station orders are being received in good volume. Line material is moving steadily and recently a number of orders for line insulators were placed. Poles and wire are active and demands for materials for winding up work on a number of line extensions are quite strong.

Industrial equipment sales show an encouraging trend. An order for motors amounting to $30,000 was received, and in addition switch and control apparatus amounting to $25,000 was ordered for delivery to a northern Massachusetts mill. Turbo-generators are being considered by a number of plants. Small motor sales gained. A lot of 100 was ordered for a Massachusetts knitting mill. Small switch and control equipment shows an upward tendency in sales. Electrical specialties are attracting attention and sales of automatic electric traffic signals are active. Electric furnaces are active and negotiations for several of these for western delivery at an early date are under way. Construction projects are as follows:

Richards & Company, Inc., Stamford, Conn., will build a power plant at its chemical works to cost $35,000.

Sales Volume Increases in Eastern District

There is an increasing demand for electrical equipment in the Eastern district both from central-station companies and industrial interests and sales volume is showing steady advance. Inquiries are keeping step with orders. A northern New York power company has contracted for a 3,000-kw. turbine unit with accessories. A Middle West manufacturer has secured a contract for a Diesel engine unit to cost $60,000. Transformer account is steady, sales have a tendency to be spotty and inquiries are lagging. A metropolitan utility has placed an order for transformer equipment to an amount of $40,000.

The call for motors and controls is holding up well from industrial consumers and sizable transactions are under way. Metal-working plants and iron and steel mills are particularly prominent in the demand, while chemical plants, cement mills, food product factories and woodworking plants are also active purchasers. An Eastern manufacturer has secured a large contract from a cement mill in Texas. Fractional-horsepower units are recording excellent sales for refrigerator, oil burner and other service. A maker of talking machines in New England has contracted for a quantity of induction disc motors to an amount of $75,000. A producer of control equipment reports September business as exceptionally good, with inquiries developing to an unexpected volume.

According to a manufacturer of line equipment, sales are a little below average for this time of the year. Future account, however, looks encouraging and sizable commitments are expected after the turn of the month. Railway business is showing signs of early revival and it is anticipated that current demand for minor items will give way to contracts of substantal extent. Insulation sales are good and there is an excellent tone in the present market. Radio equipment manufacturers are making substantial purchases and new markets are opening up in an encouraging manner for insulating materials. In this latter connection a manufacturer reports an order amounting to about $30,000, from a maker of shaving cream for material to be used for cream tube caps. Electric elevators are securing substantial commitments. Construction activities in the Eastern district include:

The Chamberlin Aeronautical Corporation and the Crescent Aircraft Corporation, Lindenhurst, L. I., associated organizations, plan a plant at Jersey City, N. J., to cost $100,000. The Aluminum Company of America, Inc., Pittsburgh, plans an addition to its plant at Massena, N. Y., to cost $500,000. The Houde Engineering Corporation, Buffalo, plans an addition to its automobile equipment plant to cost $85,000. The Curtiss Aeroplane & Motor Company, Buffalo, plans a plant at Tonawanda, N. Y., to cost $1,500,000. The Ritter Dental Manufacturing Company, Rochester, N. Y., plans an addition to cost $200,000. Charles Pfizer & Company, Brooklyn, N. Y., will soon take bids for a chemical manufacturing plant, to cost $250,000. The South Jersey Port Commission and City Council, Camden, N. J., plan a marine terminal to cost $2,000,000. The Public Service Electric & Gas Company, Newark, N. J., will build a power substation on Norfolk Street, to cost $50,000.

Morris, Wheeler & Company, Philadelphia, plans an iron and steel works on local site to cost $1,000,000. The York Ice Machinery Company, Philadelphia, plans a plant to cost $140,000. The Philadelphia Air Terminal, Inc., Philadelphia, recently organized, plans an airport at South Philadelphia, to cost $1,000,000, and will install a flood-lighting system. The Philadelphia & Reading Coal & Iron Company, Philadelphia, plans an electric-operated coal breaker near Locust Summit, Pa., to cost $500,000. The American Welding Company, Carbondale, Pa., plans additions to cost $100,000. Scranton, Pa., will soon take bids for a technical and vocational high school addition to cost $500,000. The Philadelphia Rapid Transit Company, Philadelphia, plans a car repair shop to cost $70,000. The Hazel-Atlas Glass Company, Washington, Pa., plans an addition to cost $150,000. The Crown Cork & Seal Company, Baltimore, will soon take bids for an addition to metal bottle top plant, to cost $150,000. The Board of District Commissioners, Washington, will receive bids until Oct. 5 for a quantity of cast iron lamp posts and fittings.

Good Volume of Orders Reported in Southeast

A satisfactory volume of small size central-station orders is reported for the Southeast, particularly in meter, small motor and distribution transformer lines. One company ordered 155,000 lb. of weatherproof and 30,000 lb. of bare copper wire, while another central-station order of $6,100 was for distribution and small power transformers. A rock-crushing plant in the Carolinas, recently destroyed by fire, will be rebuilt and it will purchase 600 hp. in motor equip-

ment. There is a considerable volume of industrial business, Such orders as are being placed at present by industrials are reasonably satisfactory as to total value but the individual orders are small. Construction projects are as follows:

The Parkersburg Rig & Reel Company, Parkersburg, W. Va., plans an addition to its oil drilling equipment plant, to cost $80,000. The Dixie Mineral Products, Inc., Chattanooga, Tenn., will install an electric-operated clay grinding and refinishing plant to cost $80,000. The Knoxville Power & Light Company, Knoxville, Tenn., plans a substation to cost $50,000. The Franklin Mineral Products Company, Franklin, N. C., will install a new mining and grinding plant to cost $65,000. The United States Conditioning, Analyzing & Testing Company, Charlotte, N. C., plans a plant for textile testing to cost $100,000. The Alabama Power Company, Birmingham, will make extensions in transmission lines to Gordon and Odenville, Ala., and vicinity. Hanceville, Ala., plans a transmission line to Blountsville, Ala., and vicinity. Mobile, Ala., plans a municipal power plant. Decatur, Ga., plans an ornamental lighting system. The Florida Power Corporation, St. Petersburg, Fla., plans an 8-mile transmission line to Trenton and Chiefland, Fla., and vicinity.

Active Buying Reported on Pacific Coast

There has been heavy power company buying on the Pacific Coast, including such major projects as a 2,500-kw. General Electric house turbine, valued at $35,000, and $15,000 worth of General Electric transformers. Also $30,000 worth of electric switches for the Great Western Power Company's steam-generating plant at Hunters Point, San Francisco. The Southern California Edison Company has bought 2,000 yellow pine-treated poles for an emergency order and is also in the market for 3,000,000 lb. of copper wire and about $100,000 worth of treated cedar poles for its 1929 requirements. The major machinery order reported covers two General Electric water-wheel generators complete with Pelton water wheels, which, with oil circuit breakers and accessories, totals $280,000 and is for the East Bay municipal utilities new plant on the Mokelumne River. The recent visit of the Pacific battle fleet to San Francisco is reflected in orders aggregating $5,000 for electric repair parts and turbine overhauling by the Mare Island navy yard. Other government projects include automatic telephone and radio receiving equipment for the veterans' hospital at Portland and new barracks and officers' quarters totaling $400,000 for the Rockwell flying field. The new Dodge assembling plant at San Leandro is to cost $7,000,000. Another bay region plant announced is for Sears-Roebuck in San Francisco valued at $1,500,000.

The effects of stabilization in lumber production and the upward trend in prices is being felt and mills have started replacement and expansion programs in the Puget Sound district. Inquiries reported are numerous, with the sales of motors and apparatus increasing. The sales reported include approximately 1,000 hp. in motors, ranging from 100 hp. down, to a cement company in Seattle; 30 machines totaling 600 hp. to a Tacoma sawmill; 1,500 hp. in motors, including two 600-hp. machines, for a cement plant in Spokane; fourteen pumps and motors for paper mills in Tacoma and Hoquiam and numerous small orders for mills, woodworking plants and industrials. Construction of a $500,000 cold storage plant in Victoria, B. C., Canada, is assured. A street-lighting system for Pullman, Wash., is planned. The city of Seattle will award a contract early in October for 5,800 ft. of lead-covered underground cable and white flameproof station cable. Construction projects are as follows:

The Fibreboard Products, Inc., Antioch, Calif., will build a mill to cost $200,000. The Richfield Oil Company, Los Angeles, plans an oil storage and distributing plant at Sacramento, Calif., to cost $700,000. The Southern California Edison Company, Los Angeles, plans an equipment storage and distributing plant at Porterville, Calif., to cost $35,000. The Stauffer Chemical Company, Los Angeles, plans a plant in the Compton district, to cost $100,000. The American Can Company, New York, plans a plant in the vicinity of Pittsburg, Calif., to cost $250,000. The Pacific Coast Cement Company, Seattle, will make extensions to cost $40,000. The Ralston Purine Company, St. Louis, plans a cereal mill at Denver, Colo., to cost $450,000.

Pullman, Wash., Blackfoot, Idaho, and LaJara, Colo., plan ornamental lighting systems. The Arizona Edison Company, Douglas, Ariz., plans a power plant at Naco, Ariz., and will remove the present generating station at Bisbee, Ariz., to that location. J. L. Nunn, Amarillo, Tex., and associates have secured a franchise at Melrose, N. M., and plan an electric light and power plant, and distributing system.

Improvement Continues in St. Louis District

Conditions in the St. Louis district have been maintained with additional improvement. One contract was placed for the electrical equipment on three locomotives totaling $47,000. A single order for oil well pumping and drilling motors to cost $40,000 and others being figured show continued activity in the oil fields. Contracts were placed for two switchboards, each to cost $10,000, for a power company in the Southwest and an order for switchboard transformers and other station equipment aggregating $15,000 for the northwestern part of the district. Jobbers report that the demand for building construction materials and fixtures is slightly above normal. Construction projects are as follows:

Kansas City, Mo., is arranging a fund of $350,000 for a traffic signal system. Paris, Ark., plans extensions in its municipal power plant to cost $50,000. The Arkansas Power & Light Company, Stuttgart, Ark., plans extensions in its transmission and distributing lines, and will rebuild a portion of its present system. The State Highway Department, Austin, Tex., plans a state-owned cement mill to cost $500,000. The Kansas City Southern Railroad Company, Kansas City, Mo., plans locomotive shops near Beaumont, Tex., to cost $300,000. Brownsville, Tex., plans a municipal fire alarm system to cost $30,000. The Central Power & Light Company, San Antonio, Tex., plans a hydro-electric plant in the vicinity of Eagle Pass., Tex., to cost $150,000, with transmission lines.

Trade Continues Steady in Middle West

Good business continues in most sections of the Middle West. Many of the utility companies have completed their extension work, particularly in the Chicago district, and attention is being given to overload conditions resulting in increased activity and increased consumption of materials. Interesting orders placed include the construction of a plant addition valued at $110,000, steam piping, etc., valued at $80,000, high pressure blowoff and non-return valves costing $16,000, one Kellogg forge and hammer steam receiver, 500,000 lb. of weatherproof wire and cable, 300,000 lb. of hard-drawn copper bus-bar, disconnecting switches valued at $30,000, "Mazda" lamps valued at $150,000 and construction orders aggregating $50,000. Jobbers' sales are normal. Construction projects are as follows:

The University of Wisconsin, Madison, Wis., plans a mechanical engineering building, to cost $575,000. The Long Manufacturing Company, Detroit, plans an addition to its automobile equipment manufacturing plant, to cost $75,000. The Olds Motor Works, Lansing, Mich., plans an addition to cost $500,000. The Laboratory Products Company, Mason, Mich., plans an addition to its prepared food manufacturing plant to cost $85,000. Waupaca, Wis., Calumet City and Mount Prospect, Ill., plan ornamental lighting systems. The Rockton Electric Company, Rockton, Ill., operated by the Wisconsin Power & Light Company, Madison, Wis., plans a hydro-electric plant to cost $150,000. The Baker Manufacturing Company, Springfield, Ill., plans an addition to its road machinery plant to cost $60,000. The National Tile Company, Anderson, Ind., plans an addition to cost $100,000. The Emge Packing Company, Fort Branch, near Evansville, Ind., will make extensions in its plant to cost $100,000. The Studebaker Corporation, South Bend, Ind., plans four units to cost $450,000. The Container Corporation of America, Cincinnati, Ohio, plans an addition to cost $100,000. The Metal Aircraft Corporation, Cincinnati, Ohio, plans a plant to cost $70,000. The American Crystal Company, Cleveland, plans an electric-operated mining plant on its mineral lands near Caddo Gap, Ark. The Eaton Axle & Spring Company, Cleveland, plans an addition to cost $500,000. The Board of Clark County Commissioners, Springfield, Ohio, will soon take bids for a power plant at the County Children's Home. The Otter Tail Power Company, Fergus Falls, Minn., will build a transmission line from Munich to Hampton, N. D., and vicinity, including substation facilities at the latter place. Benson, Minn., plans rebuilding its municipal electric light and power plant. The city council of Wayne, Neb., will be in the market for $55,000 worth of new equipment, specifications adopted calling for oil engine of 600 hp. capacity. The Nebraska Electric Power Company, Scottsbluff, Neb., has secured permission to construct 50 miles of transmission lines to Big Spring, Neb., from its Ogallala plant.

Activities of the Trade

National Battery Manufacturers Hold Convention

The National Battery Manufacturers' Association held its annual convention at the Ambassador Hotel, Atlantic City, N. J., on Sept. 20 and 21. The exhibits of the products used in the making of batteries attracted a great deal of attention. Papers on technical as well as general subjects included a talk by J. B. Perlman of the Hartford Battery Manufacturing Company on "What of the Future in the Battery Industry"; "A Uniform Cost Accounting System for the Battery Industry," by A. F. Strayer, treasurer of the USL Battery Corporation; "Export Conditions," by E. L. Bacher of the Chamber of Commerce of the U.S.A.; "Standardization," by Dr. G. W. Vinal, physicist of the Department of Commerce; "Some Significant Trends in the Automobile Industry," by G. M. Graham, vice-president of the Willys-Overland Company, and also a talk by E. C. Handler of the Lyons Storage Battery Company, known as the "Will Rogers" of the battery industry.

Another special feature on the program was the showing of the film "Life in the Jungles," by the Rakuda Wood Products Company of Pittsburgh, Pa.

Burke Electric Company Elects Directors

At the annual meeting of the stockholders of the Burke Electric Company held at the company's office in Erie, Pa., the following directors were elected: Alfred J. Hernsheim and Alexander H. Kridel of New York City, James Burke, G. R. Metcalf, J. C. Spencer, J. R. McDonald, G. H. Winkler, E. F. G. H. Faure, G. Irving Blake, C. H. Schum and R. W. DeLancey of Erie, Pa.

N.E.M.A. Wire and Cable Section's New Officers

Forty wire and cable manufacturers were represented at a meeting of the wire and cable section of the National Electrical Manufacturers' Association, 420 Lexington Avenue, New York, at the Westchester-Biltmore Country Club, Rye, N. Y., on Sept. 19. Election of officers and the addition of eight new wire and cable manufacturers to the National Electrical Manufacturers' Association membership were outstanding results of the business program. As originally organized the wire and cable section included only the rubber-covered group. The scope of the section, which was greatly enlarged at the meeting, is now divided into the five working groups of bare and weatherproof, flexible cord, magnet wire, power cable and rubber-covered wire.

Applications for membership in the National Electrical Manufacturers' Association, subject to the customary letter ballot, were received at the meeting from the following companies: Ansonia Electrical Company, Baltimore Copper Mills Division of the General Cable Corporation, Dudlo Manufacturing Company Division of the General Cable Corporation, Inland Wire and Cable Company, Providence Insulated Wire Company, American Brass Company, Maring Wire Corporation and the Seward Wire Company.

Hoover Electric Cleaner Reaches Twentieth Birthday

In October the Hoover Company of North Canton, Ohio, will observe the twentieth birthday of the Hoover electric cleaner. During the twenty years more than 2,250,000 Hoovers, worth $150,000,000, have been sold.

Sales activity is maintained in fifteen countries, in Europe, Australia and America, but the product was sold last year in 52 additional countries in which no sales organization is maintained. About 6,000 dealers distributed the Hoover product and all sales are dealer sales. These have been aided by an exceedingly well-developed advertising policy.

THE WESTINGHOUSE ELECTRIC ELEVATOR COMPANY, Westinghouse Building, 150 Broadway, New York City, a subsidiary of the Westinghouse Electric & Manufacturing Company, has appointed R. F. Moon as its New York district manager.

COPELAND PRODUCTS, INC., Detroit, manufacturer of electric refrigerators, reports that in a sales contest covering the entire United States and conducted by the company the ten prize-winning cities have been announced by W. D. McElhinny, vice-president in charge of sales. They are Los Angeles, Boston and Springfield, Mass., Oklahoma City, Milwaukee, Akron and Youngstown, Ohio, Memphis, Madison, Wis., and Spartanburg, S. C.

Edison Lamp Agents Launch "Six-Shooter" Campaign

IN A series of two mammoth sales meetings the New York district of the Edison Lamp Works and its distributors fired the opening guns in the "Six-Shooter" fall sales activity on Edison "Mazda" lamps. The "Six-Shooter" idea is based on the reputation of the Western cowboy who always got what he went after. It encourages the sale of lamps by the carton of six, instead of one or two lamps at a time. The purpose of the meetings was to familiarize those in attendance with the features of the campaign and to show by discussion and actual stage demonstration the most effective sales and merchandising methods for selling lamps by the carton.

The meetings, known as the "Six-Shooter Camp," were held Sept. 18 and 21 at Mazdabrook, Parsippany, N. J., a country club maintained for the personnel of the incandescent lamp department of the General Electric Company by that organization. Buses and private cars transported the more than fifteen hundred members of retail and distributing agents' organizations that attended. A large circus tent, similar to those used at Chautauquas, housed the conferees during the sessions. Another smaller tent, known as the Ammunition Tent, contained exhibits of sales aids to enable the agent more easily to sell lamps by the carton.

Every phase of the "Six-Shooter" activity was covered in detail. Executives of the Edison Lamp Works spoke on sales problems and possibilities and demonstrated by means of several amusing and instructive stage playlets the good and bad in lamp merchandising, pointing out the pitfalls of ineffective and ill-advised sales methods.

Lincoln Salesmen View New Welding Equipment

The doors of the Lincoln Research Laboratories, Cleveland, were thrown open on Sept. 14 and 15 to the salesmen of the Lincoln Electric Company, who came from all parts of the United States and Canada to view the important new developments in the design of electric arc-welding equipment. Demonstrations and comparative tests were made before the assembled salesmen showing the improved performance and the increased ease of operation of the newly equipped "Stable-Arc" welders. The radical changes in the design of the new equipment displayed spectacular engineering on the part of the company's research engineers and it is believed will cause much favorable comment when the new developments are announced to the trade. The wide range of application of the electronic-tornado principle to automatic arc-welding was also demonstrated at the sales convention.

D. M. FRASER, LTD., 24 East Adelaide Street, Toronto, Canada, has established a branch office at 35 Notre Dame Street West, Montreal, P. Q., Canada. G. Ernest Robertson has been appointed manager.

New Equipment Available

Vacuum Tube for Elevator Control

A new system of elevator control, by means of which elevator cars are automatically brought to the correct floor level, was recently announced by the General Electric Company. This method, described as being unusually simple in operation and involving but few extra parts, involves the use of a three-element vacuum tube similar to those used in radio sets.

The vacuum tube is known as a pliotron and has been used for a number of years on railroad locomotives for the purpose of transmitting block signals into the engineer's cab in visible form so that the engineer does not have to depend on watching the semaphore and light on the side of the track. While it is similar to the common radio vacuum tube, it differs in the value of operating voltages which are used.

The use of the pliotron in the automatic leveling of elevator cars is based on the characteristic increase of plate current when the tube changes from an oscillating to a non-oscillating condition. A suitable number of tubes are mounted on each elevator car and these tubes are normally in oscillation. By an arrangement of coils and vanes the motion of the car as it approaches a floor level is made to stop the oscillation of the tubes, thus actuating relays. The relays govern control circuits which slow up the car and stop it at the correct position. The new method controls the car when running in either direction.

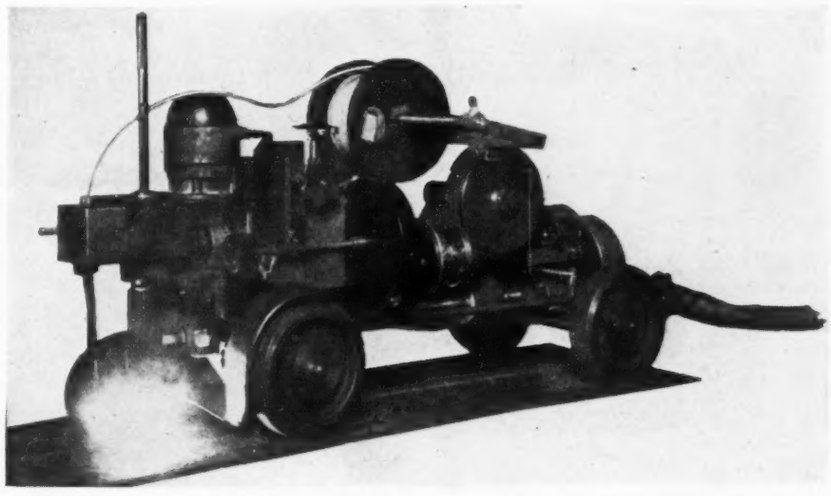
Automatic Synchronizer Works on New Principle

An automatic synchronizer, working on an entirely new principle, has been developed recently by the Westinghouse Electric & Manufacturing Company. It provides an accurate and positive method of paralleling two alternating-current sources in a minimum amount of time with less possibility of damage to station equipment and with lessened disturbances and lower surges on the transmission line to which the generators are connected.

This automatic synchronizer is designed to parallel two alternating-current sources when the phase-angle displacement between the alternating voltage waves is zero and the frequency difference is below a certain value, depending on the particular application. It can be adjusted to operate only between definite frequency different limits and to close its contacts at a certain phase advance, which will be proportional to the momentary frequency difference. The amount of advance, or the time elapsing between the energizing of the breaker closing relay and the closing of the breakers, can be varied by a single adjustment to suit varying conditions encountered in different circuit breaker applications. Tests run on this equipment prove that it will synchronize two alternating-current sources more quickly and with greater accuracy than can be done manually.

Automatic Tractor Type Tornado Welder

An automatic tractor type arc welder utilizing the electronic-tornado principle and used for making lap welds and butt welds on large tank bottoms and roofs, large pipe and on similar work, has been placed on the market by the Lincoln Electric Company, Cleveland, Ohio. The machine, as shown in the accompanying illustration, consists of an electronic-tornado head mounted on a self-propelled four-wheel-drive carriage. Power is supplied through a flexible cable and all that is necessary is to line up the machine over the seam to be welded and to start the arc; the electrode and fibrous autogenizer are fed automatically as the tractor travels forward.



Automatic tractor type tornado arc welder

In making lap welds with this machine no additional filler metal is used. The heat of the carbon arc fuses the edge of the top plate into the lower plate, making a leak-proof joint. A filler strip is laid over the seam to be welded when a butt weld is desired.

BAR HANGERS WITH PERFECTED FIXTURE STUD.—A complete line of improved bar hangers, equipped with a fixture stud operating on an entirely new principle, has been placed on the market by the merchandise department of the General Electric Company. A special convex lock-nut fastens the stud to the outlet box, which may still be moved to any position on the bar. A half turn of the adjusting screw located in the core of the stud rigidly secures the unit to the bar at the desired point. The straight bar hanger, 18 in. long, is especially suited for mounting shallow ceiling or outlet boxes ½ in. deep. If the bar hanger is to be used with concrete work, the bar serves as an effective anchor. The ends of the bar are spread to prevent the stud from slipping off the bar and being lost. A straight 24-in. bar hanger is also supplied. The shallow offset bar hanger, 19½ in. long, is for mounting boxes 1½ in. deep when no cover is to be used. The offset is of the correct depth to bring the box flush with the plaster line.

MOTOR-OPERATED VALVE FOR CHROMIUM PLATING.—A new device for controlling the temperature of chromium plating tanks is offered by the St. Louis Motor Valve Company, St. Louis, Mo. The device is electrically operated and may be installed with ease. A special totally inclosed reversible motor of General Electric manufacture drives a threaded shaft through a double-worm reduction gear mechanism. A lever, connected to this shaft and pivoted in its center, is arranged to operate two valves alternately, one for steam and one for water. A limit switch, at the top of the cast aluminum housing, stops the motor at proper positions. The complete control consists of a contact-making thermometer, either of recording or indicating type, a relay panel, and duplex valve unit.

CAPPED BUSHINGS OF IMPROVED TYPE. An improved line of capped bushings, introduced by the General Electric Company, assures an effective seal for conduit during construction work. The cap is securely fastened in place so that it will not fall out from an accidental blow, yet it can easily be removed when desired. The bushings are of malleable iron, galvanized. The inner top shoulder is smoothly rounded to prevent abrasion of the wires. The side ribs offer a non-skid grip to fingers or pliers. The bushings are made in three sizes, 1, ½ and ¾ in.

Electrical Patents

Announced by U. S. Patent Office

(Issued Sept. 11, 1928)

1,683,590. IMPULSE LIGHTNING ARRESTER; A. L. Atherton, Pittsburgh, Pa. App. filed Aug. 22, 1922.

1,683,591. CLOSED-CIRCUIT COOLING FOR ELECTRICAL MACHINES; A. Baumann and W. vanRijswijk, Baden, Switzerland. App. filed Sept. 8, 1927.

1,683,598. SOCKET AND FUSE PLUG; H. W. Benoit, Watertown, N. Y. App. filed Jan. 30, 1925.

1,683,599. LUMINAIR; P. W. Berry, Reading, England. App. filed April 30, 1924.

1,683,601. ALTERNATING-CURRENT COMMUTATOR MOTOR; D. M. Bliss, Chicago, Ill. App. filed June 23, 1927.

1,683,676. DYNAMO-ELECTRIC MACHINE; H. G. Jungk, Pittsburgh, Pa. App. filed Dec. 15, 1924.

1,683,696. ALTERNATING-CURRENT RELAY; L. H. Peter, London, England. App. filed Feb. 18, 1928.

1,683,706. HOLLOW-SHAFT COLLECTOR-LEAD SUPPORT; T. S. Scott, Pittsburgh, Pa. App. filed April 30, 1926.

1,683,717. ELECTRICALLY-OPERATED HAIR-CURLING MACHINE; C. Fayer, Flushing, N. Y. App. filed Nov. 23, 1926.

1,683,740. ELECTRICAL HEATER; W. K. Tavender, Haworth, N. J. App. filed Jan. 18, 1927.

1,683,762. WORK HOLDER FOR WELDING; W. H. D'Ardenne, Lawndale, J. O. Landis, Fox Chase, and L. H. Christensen, Philadelphia, Pa. App. filed Sept. 12, 1925.

1,683,783. COMBINED LIGHTNING ARRESTER AND RESISTANCE UNIT; C. J. Kelloway, Wilmington, N. C. App. filed Jan. 22, 1923.

1,683,785. VOLTAGE REGULATOR; R. Kummenich, Berlin, Germany. App. filed Aug. 18, 1925.

1,683,794. ELECTRIC HAMMER; W. C. O'Brien, Canton, Ohio. App. filed July 27, 1922.

1,683,819. ORIENTED ELECTRICAL CONTACTOR; P. E. Edelman, Chicago, Ill. App. filed Dec. 15, 1927.

1,683,856. AUTOMATIC CONTROL DEVICE; T. F. Baily, Alliance, Ohio. App. filed Aug. 20, 1926.

1,683,886. MANUFACTURE OF STEEL; R. A. Hadfield, Westminster, England. App. filed Nov. 20, 1922.

1,683,889. FOOD CONTAINER AND HEATER; W. G. Hayne, Brooklyn, N. Y. App. filed June 13, 1927.

1,683,904. SUSPENSION-CHAIN COUPLING; P. J. Knoblock, Passaic, N. J. App. filed Aug. 19, 1927.

1,683,981. MAGNETIC SHARPENER FOR RAZOR BLADES; T. G. Lovegrove, Philadelphia, Pa. App. filed July 21, 1925.

1,683,986. INDUCTION PRESSURE OR VACUUM FURNACE; E. F. Northrup, near Princeton, N. J. App. filed Aug. 1, 1925.

1,683,992. CIRCUIT INTERRUPTER AND SOCKET; M. H. Shoenberg and L. Schon, San Francisco, Calif. App. filed May 24, 1926.

1,683,993. ELECTRICAL CIGAR LIGHTER; M. H. Shoenberg and L. Schon, San Francisco, Calif. App. filed Aug. 9, 1926.

1,684,001. ALPHABETICAL KEYBOARD PUNCH; A. Weiland, Neshanic, N. J., H. R. Russell, Douglaston, N. Y., and C. A. Metzger, New Brunswick, N. J. App. filed July 28, 1925.

1,684,013. VARIABLE INDUCTANCE; J. C. DePue, San Antonio, Tex. App. filed Oct. 14, 1926.

1,684,042. APPARATUS FOR CONTROLLING THE POSITIONING OF DEVICES FROM A DISTANCE; N. E. Methlin, Paris, France. App. filed May 20, 1924.

1,684,056. ELECTRICAL MEASURING INSTRUMENT; R. D. Evans, Wilkinsburg, Pa. App. filed Sept. 10, 1924.

1,684,060. MAGNETIC SWITCH; H. D. James, Edgewood Park, Pa. App. filed March 1, 1923.

1,684,065. ELECTRICAL MEASURING INSTRUMENT; D. F. Miner, East Pittsburgh, Pa. App. filed May 7, 1924.

1,684,066. INSULATOR; D. F. Miner, East Pittsburgh, Pa. App. filed Sept. 23, 1924.

1,684,073. ELECTRICAL POWER EQUIPMENT; M. Rotter, Milwaukee, Wis. App. filed Nov. 15, 1924.

1,684,077. SPEED-REGULATOR SYSTEM; S. A. Staege, Pittsburgh, Pa. App. filed April 12, 1921.

1,684,108. ELECTRIC WELDING; G. H. Phelps, Warehouse Point, Conn. App. filed Oct. 22, 1921.

1,684,112. PREHEATER FOR TYPE AND LEAD CASTING MACHINES; R. J. Roberts, San Francisco, Calif. App. filed Sept. 24, 1927.

1,684,132. MEANS FOR REPRODUCING POSITION; E. M. Hewlett and W. W. Willard, Schenectady, N. Y. App. filed Nov. 30, 1925.

1,684,137. MEANS FOR REPRODUCING POSITION; A. H. Mittag, Schenectady, N. Y. App. filed Nov. 30, 1925.

1,684,138. MEANS FOR REPRODUCING POSITION; S. P. Nixdorff, Schenectady, N. Y. App. filed Sept. 29, 1925.

1,684,148. DISCONNECTING SWITCH; F. Ronneberger, Berlin, Germany. App. filed Feb. 16, 1927.

1,684,149. WATTHOUR METER; A. R. Rutter, Forest Hills, Pa. App. filed Nov. 19, 1926.

1,684,151. VOLTAGE REGULATOR; W. Schaelchlin, Wilkinsburg, Pa. App. filed Jan. 28, 1926.

1,684,152. INSULATOR; W. H. Schramm, Pittsburgh, Pa. App. filed March 10, 1927.

1,684,161. ELECTRICAL OUTLET; S. M. Traubitz, New York, N. Y. App. filed Nov. 16, 1927.

1,684,166. PLUG FOR ELECTRIC-LIGHT SOCKETS; H. A. Austin, Kalamazoo, Mich. App. filed May 20, 1926.

1,684,168. ROTARY OILER AND VENTILATION; C. Bethel, Wilkinsburg, and F. W. McCloskey, Edgewood, Pa. App. filed April 12, 1926.

1,684,170. THERMAL PLUG CUT-OUT; E. K. Clark, Mansfield, Ohio. App. filed April 2, 1927.

1,684,176. WAFFLE-IRON HEATING ELEMENT; F. F. Forshee, Mansfield, Ohio. App. filed Oct. 10, 1925.

1,684,178. TROLLEY; C. A. Gouty, Bushnell, Ill. App. filed Oct. 12, 1925.

1,684,182. AUTOMATIC VOLTAGE CONTROL; G. C. Hubble, Bonners Ferry, Idaho. App. filed March 17, 1926.

1,684,183. ELECTRIC PLUG; W. Ile, Little Falls, N. J. App. filed March 19, 1925.

1,684,184. METHOD OF MAKING HEATER UNITS; W. R. King, Mansfield, Ohio. App. filed Feb. 1, 1927.

1,684,191. ELECTRICAL MEASURING INSTRUMENT; W. G. Mylius, Wilkinsburg, Pa. App. filed March 17, 1927.

1,684,207. TRAFFIC SIGNAL; C. D. Smyth, Rox, Nev., and G. M. Robey, Los Angeles, Calif. App. filed July 15, 1924.

1,684,236. SYSTEM OF ELECTRIC SHIP PROPULSION; C. Macmillan, Schenectady, N. Y. App. filed March 14, 1923.

1,684,241. TELEMETRIC IMPULSE SUMMATION SYSTEM; W. H. Pratt and D. R. Price, Lynn, Mass. App. filed Nov. 16, 1926.

1,684,243. MEASURING DEVICE; T. A. Rich, East Lynn, Mass. App. filed June 25, 1926.

1,684,245. CEILING BOX; W. T. Ruete, New York, N. Y. App. filed Oct. 17, 1923.

1,684,247. MOTOR-CONTROL SYSTEM; C. Schiebeler, Berlin, Germany. App. filed June 20, 1927.

1,684,249. AUTOMATIC CIRCUIT CONTROLLER; A. R. Stevenson, Jr., Schenectady, N. Y. App. filed Feb. 9, 1925.

1,684,253. DYNAMO-ELECTRIC MACHINE; F. P. Whitaker, Rugby, England. App. filed July 27, 1925.

1,684,255. MAGNETIC WEDGE; S. R. Bergman, Nahant, Mass. App. filed Feb. 8, 1926.

1,684,256. CONTROL SYSTEM; E. F. Bliss, Alplaus, N. Y. App. filed Aug. 14, 1924.

1,684,260. VIBRATORY DEVICE; H. W. Brown and A. E. Bailey, Jr., Schenectady, N. Y. App. filed July 28, 1925.

1,684,267. MOTOR CONTROLLER; W. S. H. Hamilton, Schenectady, N. Y. App. filed Dec. 10, 1925.

1,684,268. INCANDESCENT-LAMP SOCKET; D. Hays, Bridgeport, Conn. App. filed Nov. 3, 1924.

1,684,280. ELECTRIC SWITCH; D. F. Jones, Beloit, Wis. App. filed June 14, 1926.

1,684,281. TEMPERATURE REGULATOR FOR ELECTRIC HEATERS; W. D. Kelly, Western Springs, Ill. App. filed March 21, 1925.

1,684,312. ELECTRICAL INSULATOR; J. J. Fischer, Marion, Ind., and W. R. Payne, Denoya, Okla. App. filed Jan. 19, 1926.

1,684,317. ARC WELDING SYSTEM; J. F. K. Harms, Amsterdam, Netherlands. App. filed Feb. 24, 1927.

1,684,332. METHOD OF PRODUCING GLASS; M. Thomas, Weisswasser, Oberlausitz, Germany. App. filed June 26, 1926.

1,684,343. IGNITION APPARATUS FOR INTERNAL-COMBUSTION ENGINES; M. M. Cardellino, Turin, Italy. App. filed June 28, 1927.

1,684,374. ELECTRIC HOT PLATE; W. G. Nordling, Newark, N. J. App. filed Dec. 26, 1925.

New Trade Literature

MOTOR DRIVE FOR COMPRESSORS.—"Flywheel Effect Recommendations for Air Compressors Based on Ideal Synchronous Motor Drive" is the title of circular No. 501 issued by the Ideal Electric & Manufacturing Company, Mansfield, Ohio. The booklet is illustrated with Ideal installations, graphic curves, etc., and shows how to use the curve for each type of compressor. It also contains information on how to obtain flywheel effect for any type horsepower or speed.

CONDUIT FITTINGS. — The Crouse-Hinds Company, Syracuse, N. Y., has issued bulletin No. 2119, which describes and illustrates the various types of its new "Obround" condulets and wiring devices. Bulletin No. 2122 issued by the company covers its types F and LB condulets.

SWITCHES, MOTORS AND WELDING HEAD.—Bulletins GEA-23B, GEA-1052 and GEA-556B issued by the General Electric Company, Schenectady, N. Y., describe and illustrate respectively its type LG-17B indoor disconnecting switches, the G-E types TS and QS form EL general-purpose synchronous motors "7500 series" and the G-E type MC automatic welding head and control.

OUTDOOR CABLE TERMINALS.—The Standard Underground Cable Company, Pittsburgh, division of the General Cable Corporation, has issued bulletin No. 701, covering the Standard outdoor cable terminals and accessories. The bulletin contains illustrations and complete information, including drawings, dimension tables, etc. A few installation views also are included.

INSULATION RESISTANCE-MEASURING INSTRUMENTS. — Bulletin No. 170 issued by Herman H. Sticht & Company, 15 Park Row, New York City, describes and illustrates the "Standco" model DM megohmer, a combined megohmmeter and voltmeter with a self-contained direct-current generator.

CUTOUTS AND REACTORS.—Leaflet No. L. 20,005-D issued by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., describes and illustrates its type ES primary fuse cutouts. The company also is distributing leaflet No. L. 3,751-C, covering its dry-type current-limiting reactors.

HEAT EXCHANGERS, VACUUM PUMPS, ETC.—The Ross Heater & Manufacturing Company, Inc., Buffalo, N. Y., is distributing bulletin No. 133 describing Ross products consisting of heat exchangers, feed-water heaters, surface condensers, lubricating oil coolers and several other items.

EMERGENCY VALVE. — The General Electric Company, Schenectady, N. Y., is distributing bulletin GEA-990, covering its type E form L emergency valve for straight air brake equipment with emergency feature.

INCLOSED FAN-COOLDED MOTORS.—Bulletin No. 1144 issued by the Allis-Chalmers Manufacturing Company, Milwaukee, describes and illustrates its squirrel cage, type ARZ, totally inclosed fan-cooled motors.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number:

Purchase and agency are desired in Caracas, Venezuela (No. 33,425), for electric fixtures for motion-picture theaters.

Purchase is desired in Rome, Italy (No. 33,368), of electric automobile heaters.

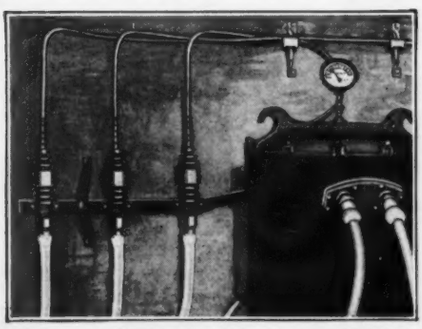
Purchase or agency is desired in Berlin, Germany (No. 33,414), for electric heating and cooking equipment and electric household appliances.

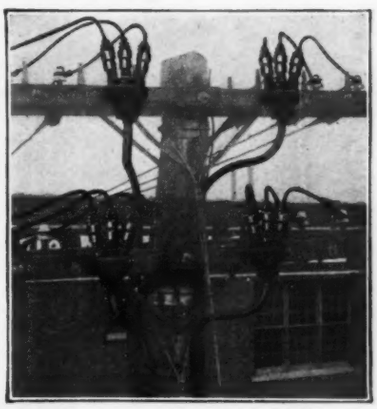
Purchase is desired in Seoul, Chosen, Japan (No. 33,415), of electric portable lighting outfit for motion-picture projectors.

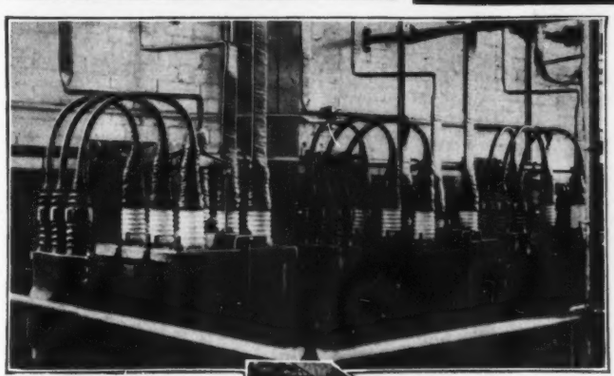
Purchase and agency are desired in Valencia, Spain (No. 33,413), for automobile storage batteries, parts and battery tools.

DISCONNECTING POTHEADS

Pictured here are actual successful installations demonstrating the various designs of G & W Disconnecting Potheads for practically any type of layout requirement. There is some one shape of G & W Disconnecting Potheads shown in our catalog which is exactly what you want to effect a neat-looking, simplified, and safe arrangement of all equipment.

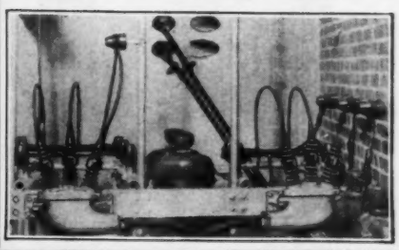


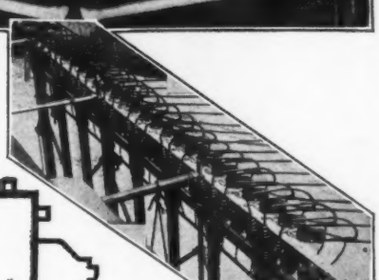




One of the outstanding features of G & W Disconnecting Potheads is space economy. Another is flexible operation.

All bare live parts are enclosed in porcelain. The diving bell design and the compounding methods assure a submersion proof job. This is attested to by the many disconnecting pothead installations which continue to function in manholes which are flooded during storms.





BOXES

G & W makes a complete line of underground cable boxes designed to modernize every layout economically. They are of unit type construction for use in manholes or hand holes for interconnecting, sectionalizing, fusing or plain splicing of underground cables. Both high and low tension types. Watertight construction a feature.

G & W Electric Specialty Co.
7780 Dante Ave., Chicago

Exactly What You Want!

G & W design and manufacture practically every device for the end of a cable. See Catalog No. 27.

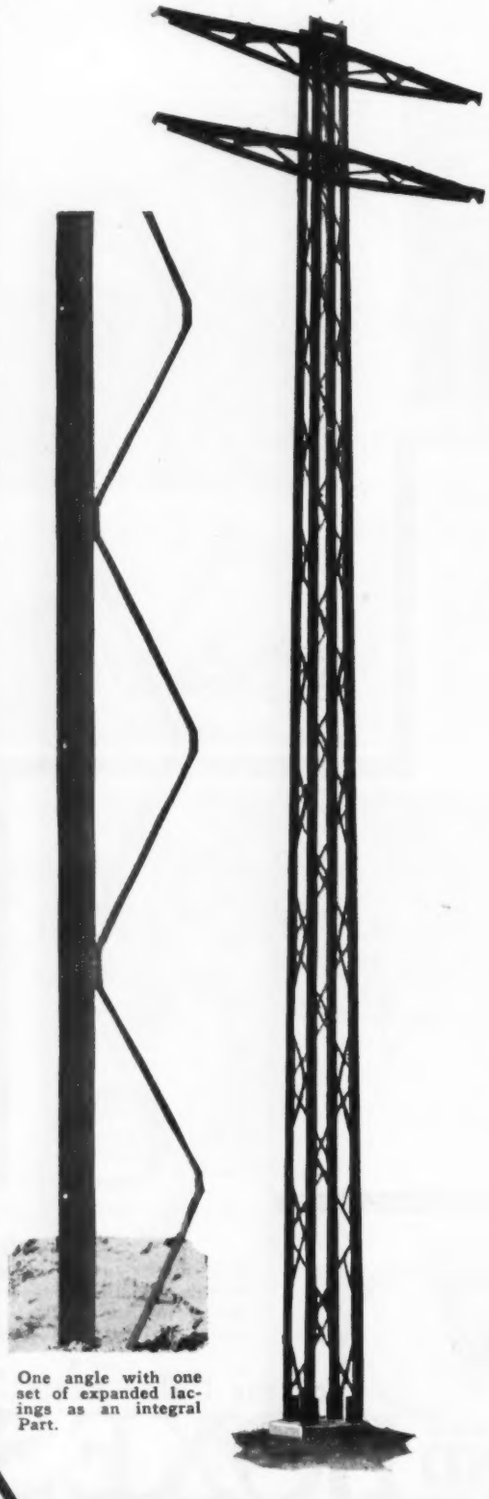
More than Protection G&W for the Cable Ends

POTHEADS AND BOXES

PAGE 6

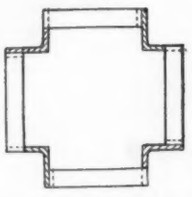
ACTUALLY REDUCING

Initial Cost with practical DESIGN



One angle with one set of expanded lacings as an integral Part.

End View

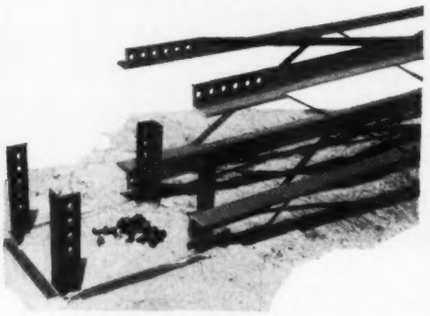


Cross Section

STEEL POLES

Erection Cost with simple CONSTRUCTION METHOD

Pole being raised into position by means of gin pole



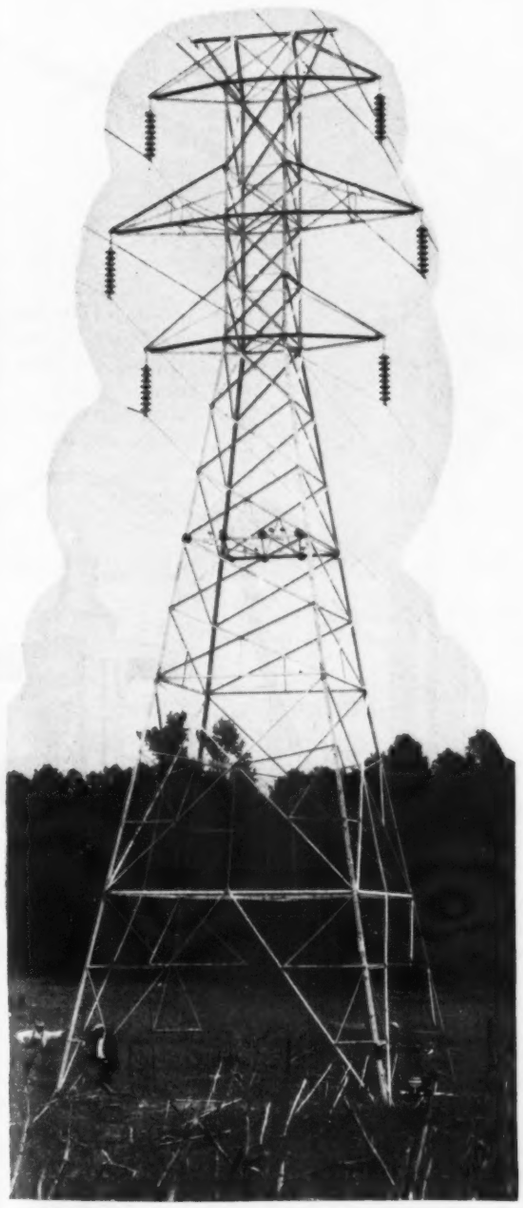
Two bolts used as hinge pins while pole is raised into position

A Steel Pole Line in a residential section

GENERAL COSTS

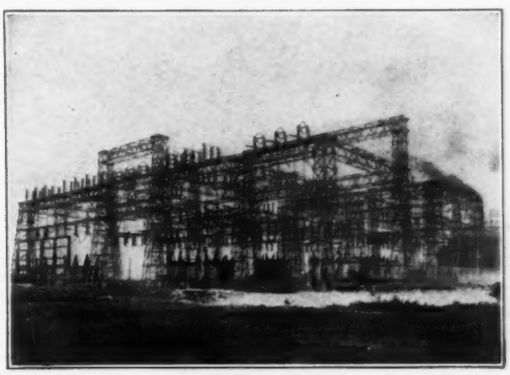
PAGE 7

Assembling Cost with effective SERVICE



"The Towers fitted together very nicely; the material was well marked and checked out splendidly"—says the owner of this large line

Manufacturing Cost with efficient EQUIPMENT



SUBSTATIONS

The World's largest electrically heated galvanizing kettle is used in our galvanizing department

STEEL FLOOR GRATING

Automatic machinery turns out faultless Floor Grating. Several thousand square feet a day

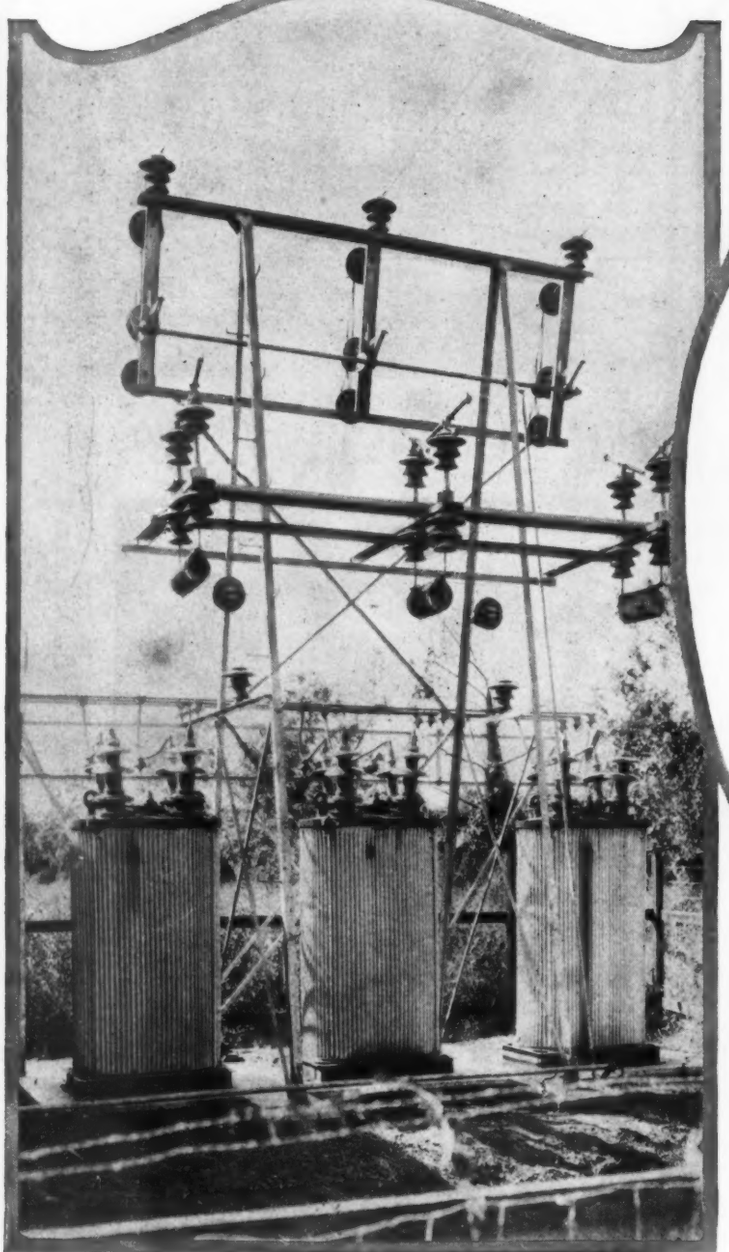
WALTER BATES STEEL CORPORATION

GARY INDIANA.

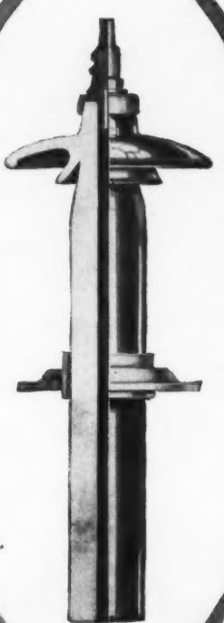
SALES OFFICES:

New York Pittsburgh Dallas Birmingham Cleveland Atlanta

O-B Helps to Safeguard Kuhlman's Record for Reliability and Economy

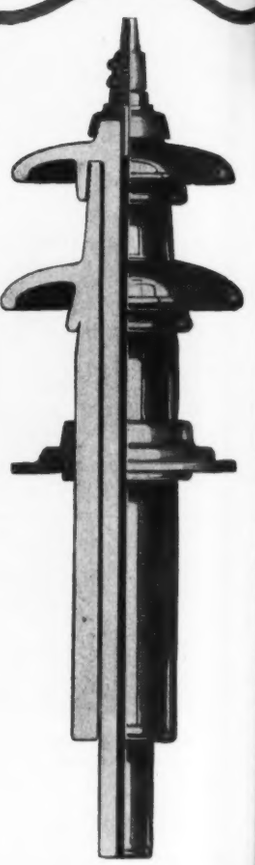


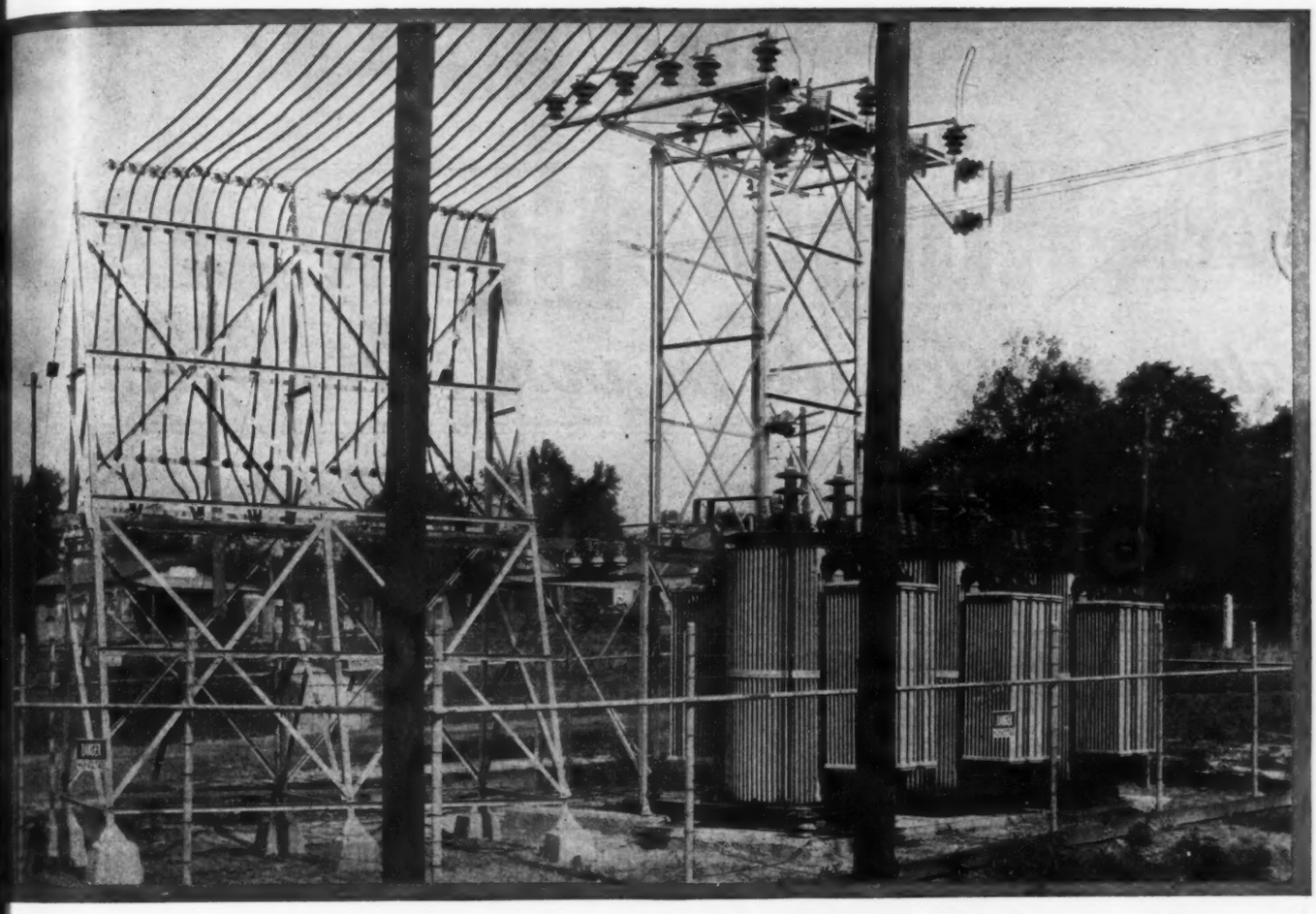
Three 75-kva Kuhlman Transformers installed on a rural experimental line of the Alabama Power Co. at Huffman, Ala. High tension voltage 22,000 to 44,000. Secondary 6,000 volts.



(Above) O-B Bushing No. 26802, employed on the low voltage side of the Kuhlman transformers shown at the left. General rating 11,000 to 16,000 volts. Page 334 O-B Catalog No. 20.

(Below) O-B Bushing No. 26808, used on the high tension side of both installations illustrated. General rating 44,000 volts. Page 344, O-B Catalog No. 20.





Three 1000-kva Kuhlman Transformers installed at the textile plant at Pell City, Ala., by the Alabama Power Company. High tension voltage 22,000 to 44,000.

IT is something over thirty years ago that the first Kuhlman Transformer was placed in service in the electrical field. With it began the establishment of that reputation for reliable and economical service which is now the rich heritage of every transformer which bears this splendid name.

Such a reputation is not won overnight, nor is it easy to secure. It builds slowly. Though it gathers strength almost imperceptibly, it is the sure and inevitable result of sound engineering judgment and good business policy. Such a reputation is but public acknowledgment of the fact that an organization makes a habit of being right in its decisions and judgments.

Thus does it become significant that Kuhlman comes to O-B for Bushings. It indicates that there is no fear that O-B Bushings will injure Kuhlman good will and reputation. It suggests the thought that these important assets will be increased thereby. It implies that *balanced design* in transformer bushings, which is so basically the O-B viewpoint, is a sound, tested theory that bears good fruit in practice.

Ohio Brass Company, Mansfield, Ohio
Canadian Ohio Brass Co., Limited
Niagara Falls, Canada
921H

Ohio Brass Co.

NEW YORK CHICAGO PHILADELPHIA PITTSBURGH ATLANTA CLEVELAND SAN FRANCISCO LOS ANGELES

PORCELAIN INSULATORS
LINE MATERIALS
RAIL BONDS
CAR EQUIPMENT
MINING MATERIALS
VALVES

The Humble Home

always effective in political appeal

The R. & I. E. birthplace

LOG cabin to President is always inspirational.

Bowling alley to industrial plant is a unique set-up, here told for the first time.

Back in 1910 three men rented an abandoned bowling alley and started making outdoor switches.

That was the humble beginning of the Railway & Industrial Engineering Company.

Today the family has grown to a force of more than 500, occupying an industrial plant composed of Engineering Department...Steel Shop ...Foundry...Galvanizing Plant ...Machine Shop...Pattern Shop ...Equipment Assembly Shop... Testing and experimental Laboratories, etc., modern in the minutest detail...a growth from 1000 sq.ft. manufacturing floor space to 120,000 sq.ft.

There was nothing PRETENTIOUS in bowling-alley birth—rather it was PORTENTOUS, foreshadowing the *10-strike* that R. & I. E. equipment has made.

RAILWAY AND INDUSTRIAL
ENGINEERING COMPANY
GREENSBURG, PA.

Boston, New York, Philadelphia, Cleveland, Pittsburgh, Cincinnati, Chicago, St. Louis, Charlotte, Albany, Birmingham, Buffalo, Casper, Dallas, Denver, Indianapolis, Kansas City, Los Angeles, Rochester, San Francisco, Toronto, Syracuse, Seattle, Salt Lake City

A rose by any other name would s.a.s.

The different items of standard pole line hardware are frequently known by different nicknames.

But whatever the name the functions do not differ—although the service may.

The major point of difference between one make and another is in easier installation and longer life.

The Oliver line embodies those qualities because of the process of galvanizing* developed by Oliver.

This process insures both qualities.

Get the facts.

*The Passinger Process

GET THE NUMBER

Use Oliver Pole Dating Nails to indicate the year poles are set.

—or to designate their height.

—also for special markings.

Page 6 Oliver Catalog

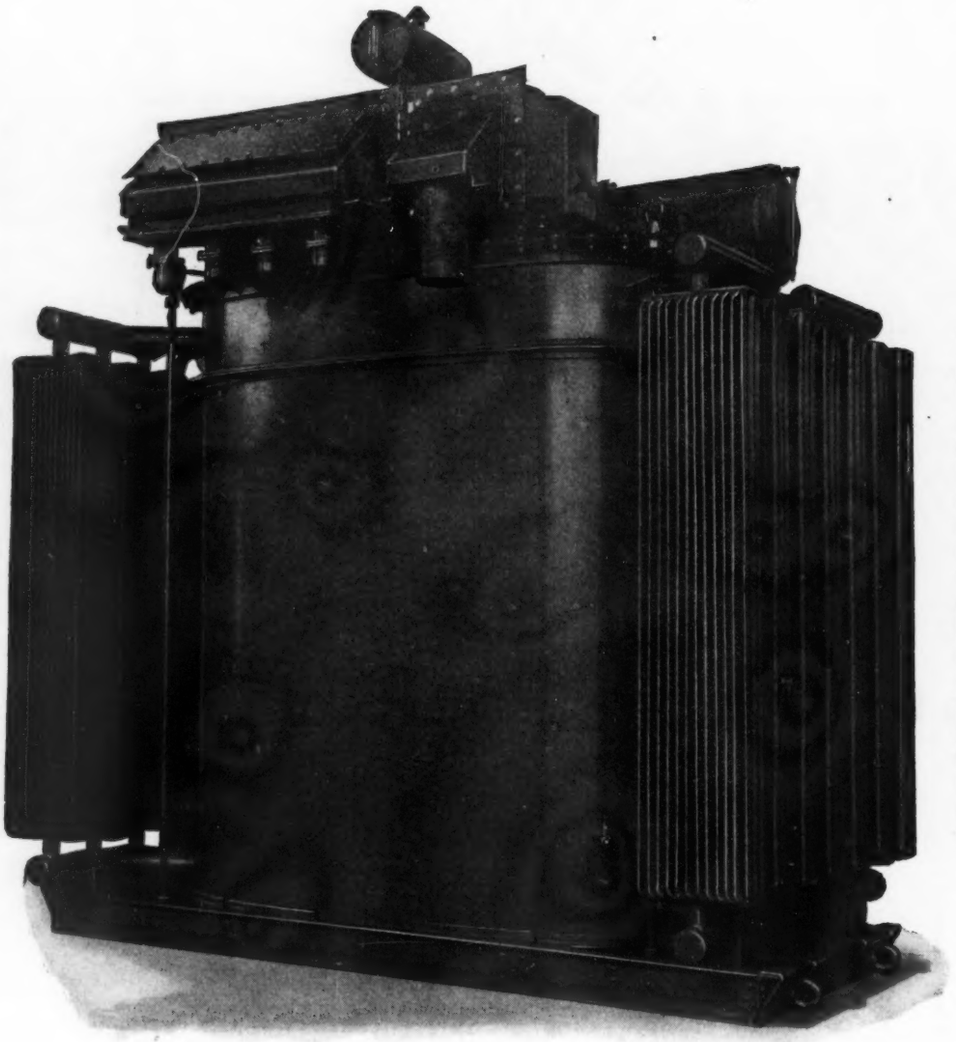
Get your quotation — *Line Material Department*

Oliver

IRON and STEEL CORPORATION

South Tenth and Muriel Sts., Pittsburgh, Pa.

"Oliver the Line"

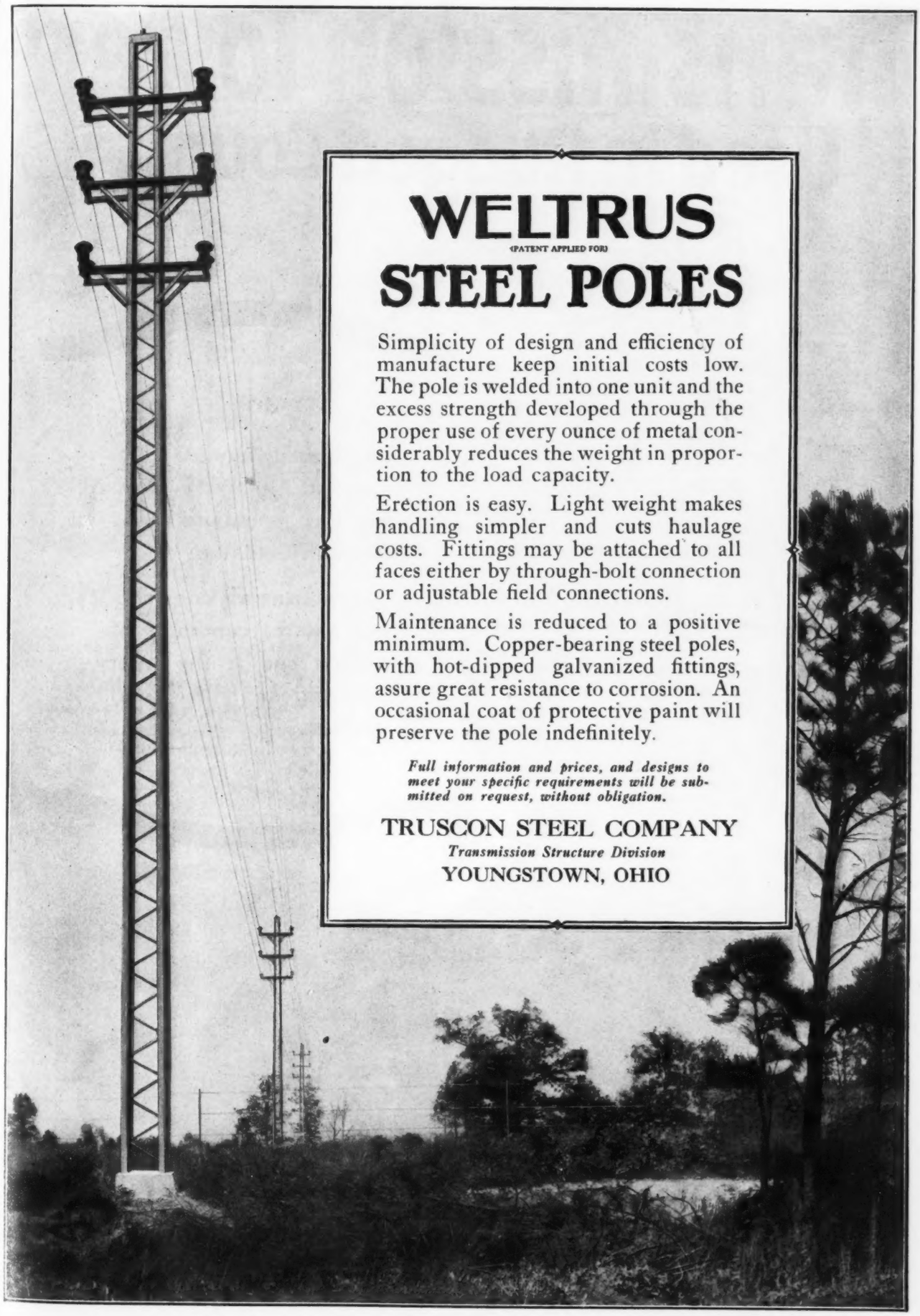


This Pittsburgh Polyphase Transformer is rated at 5250 kva., 13,800 delta volts high side and 2400 delta /4150 star volts low side. It is arranged for cable connections for both high and low voltage sides by means of potheads. The potheads are oil filled and may be disconnected from the transformer as a unit. This permits the transformer to be disconnected from the cable system without disturbing the wiped cable joints.

Pittsburgh Transformers

Pittsburgh Power Transformers both single phase and polyphase have a double magnetic circuit core. This results in noiseless and more efficient operation. The tanks and the radiators are built of copper alloy (rust resisting) steel. The rectangular base construction facilitates moving and handling. Pittsburgh Transformers with film type radiators save in floor space. Fewer radiators are required because of their very efficient heat dissipation.

ALLIS-CHALMERS MANUFACTURING CO.
PITTSBURGH TRANSFORMER WORKS
North Side, Pittsburgh, Pennsylvania



WELTRUS

(PATENT APPLIED FOR)

STEEL POLES

Simplicity of design and efficiency of manufacture keep initial costs low. The pole is welded into one unit and the excess strength developed through the proper use of every ounce of metal considerably reduces the weight in proportion to the load capacity.

Erection is easy. Light weight makes handling simpler and cuts haulage costs. Fittings may be attached to all faces either by through-bolt connection or adjustable field connections.

Maintenance is reduced to a positive minimum. Copper-bearing steel poles, with hot-dipped galvanized fittings, assure great resistance to corrosion. An occasional coat of protective paint will preserve the pole indefinitely.

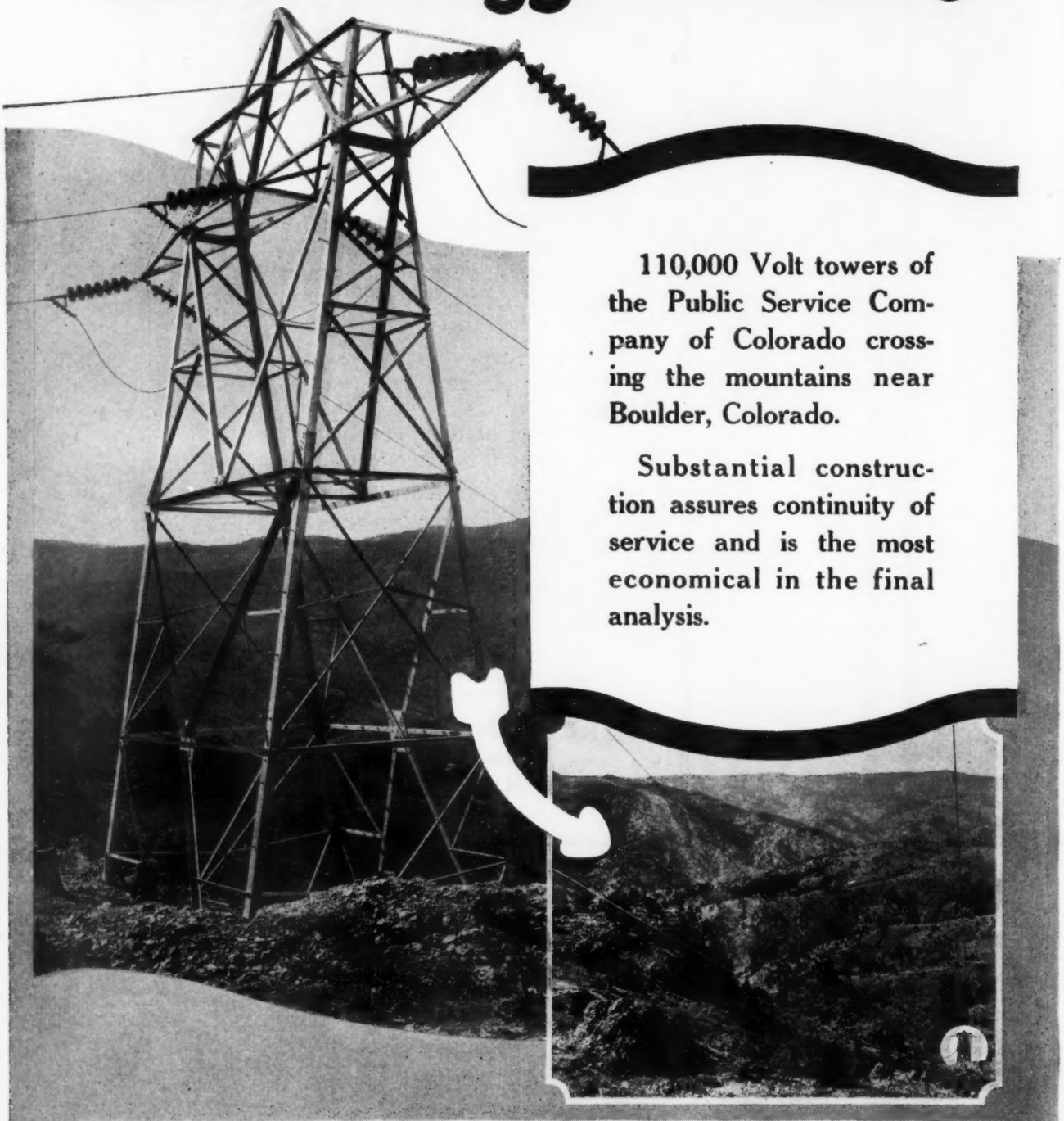
Full information and prices, and designs to meet your specific requirements will be submitted on request, without obligation.

TRUSCON STEEL COMPANY

Transmission Structure Division

YOUNGSTOWN, OHIO

Transmission Towers
Used in Rugged Country



110,000 Volt towers of the Public Service Company of Colorado crossing the mountains near Boulder, Colorado.

Substantial construction assures continuity of service and is the most economical in the final analysis.

AMERICAN BRIDGE COMPANY
71 BROADWAY, NEW YORK CITY
TOWER DEPT., FRICK BLDG., PITTSBURGH, PA.

Condit Type D-128

Compare the new Condit D line Oil Circuit Breakers point for point with any others of equal rating.

Compare the frame—Condit heavily ribbed frames, with deep extending web surrounding the tanks, afford unequalled strength and rigidity to resist shocks and impacts.

Compare the tanks—Condit tanks are of thick steel plate scientifically welded, firmly supported by heavily ribbed cradle and secured tightly to the frame by large tank rods.

Compare the contacts — Condit inverted laminated brushes of special design withstand extremely high inrush currents. Exceptionally heavy arcing contacts with large thermal absorption capacity materially reduce arcing on interruption. Until the brushes have safely parted, arcing contacts remain firmly closed.

Compare the insulation — Condit oversize, one-piece wet process porcelain bushings of ample mechanical strength to withstand high inrush currents, extending below the oil line and securely clamped to the frame, provide insulation in excess of A. I. E. E. voltage test requirements.

Compare the speed of break — Condit light weight but strong mechanism and powerful accelerating springs assisted by the strong spring action of the contacts, assure high speed of circuit interruption.

And compare the performance with that of any breaker of equal rating.

CONDIT ELECTRICAL MFG. CORPORATION

Manufacturers of Electrical Protective Devices

BOSTON, MASS.

Northern Electric Company
LIMITED

Distributor for the Dominion of Canada

Specifications: *400, 600, 800, 1200 amperes—15,000 volts; 1600 amperes—7,500 volts. Estimated interrupting capacity 5000 amperes at 15,000 volts.*

CONDIT

1705

Nature designed

for electrical

western red

the choice of the

he ideal pole

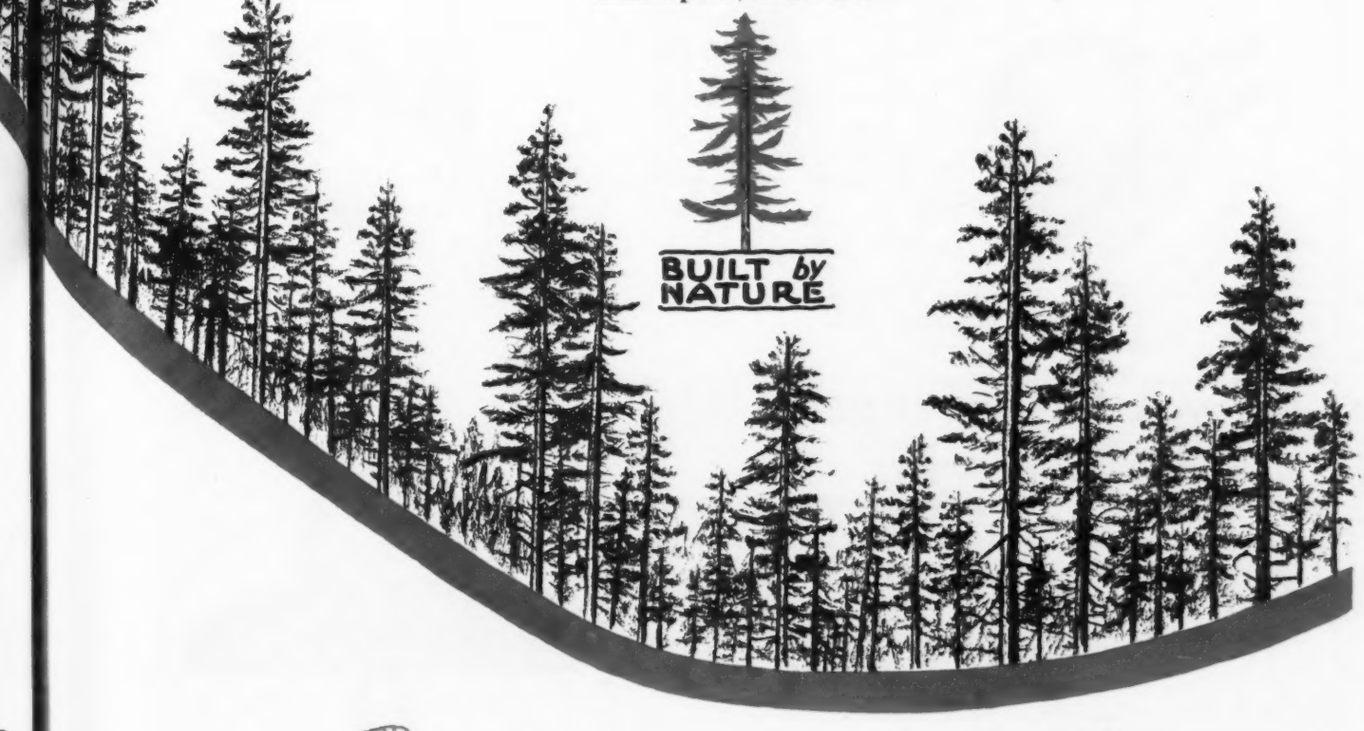
ransmission

AS if by deliberate design, Nature put into Western Red Cedar every qualification to fit it for use as a carrier of electrical conductors. Straight and clean-cut, making a sightly pole. Amply strong to withstand any stresses that service requires.

It is a non-conductor, making it safe. Light in weight making it economical to handle. Low center of gravity giving it firm anchorage. Extremely durable, it receives butt treatment only, giving decades of maintenance-free service through every kind of weather.

These are some reasons for the continued popularity of Western Red Cedar Poles with the Utilities.

WESTERN RED CEDAR ASSOCIATION
Minneapolis, Minnesota



l cedar poles

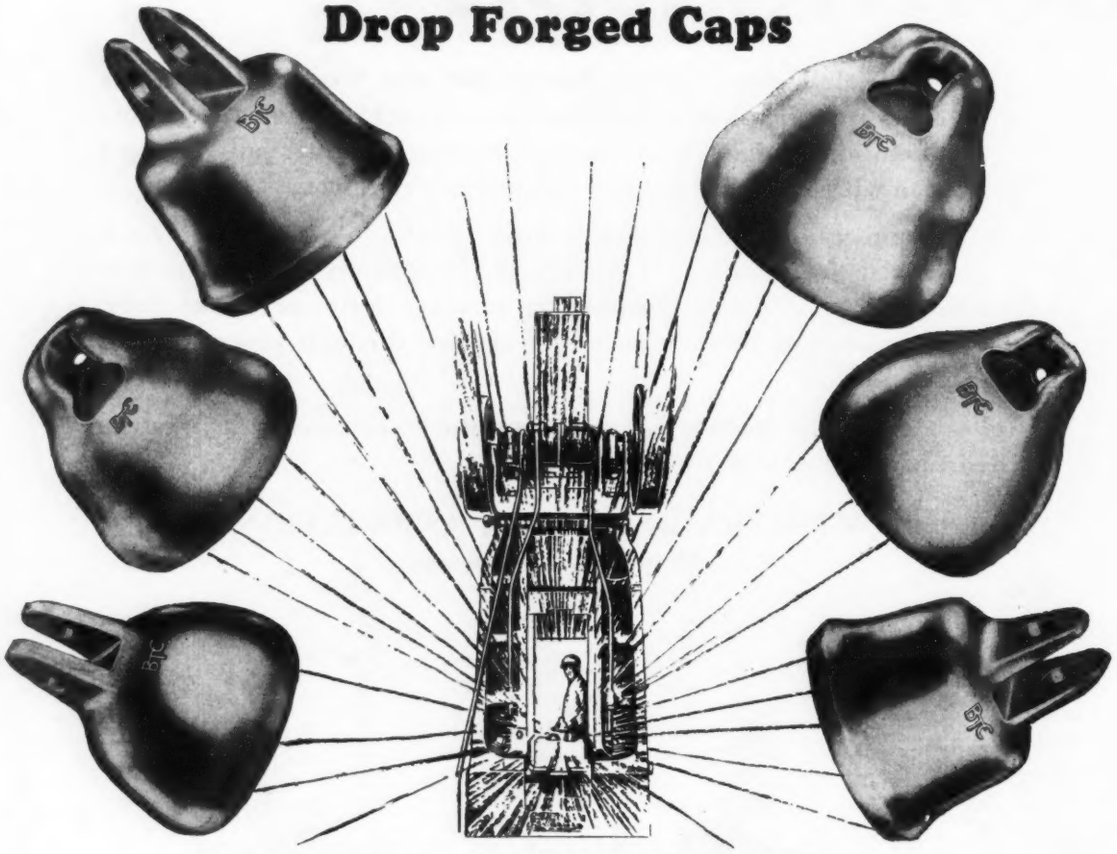
g the utilities

Drop Forgings Bring 100% Uniformity

Specify

B. T. C.

Drop Forged Caps

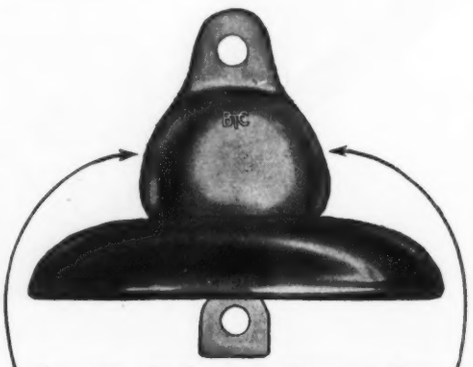


Illustrating one of The Brewer-Titchener Corporation's battery of hammers. The force of the female die (above) striking the male die (below) forces the heated metal to the desired form. Three steps are necessary to produce the form.

Why A Drop Forged Cap?

1. They are 100% uniform in quality.
2. Their superior strength has been proven by many tests.
3. They can be heat treated to a maximum strength with minimum strength.
4. Copper bearing metal resists corrosion.
5. They are free from hidden defects or concealed flaws.

Made under process patent No. 146360 issued July 31, 1923.



Specify BTC Drop Forged Caps

The Brewer-Titchener Corp.
Cortland, New York

Engineers Are Considering These Facts

Type F-120

Decathlon champions and Condit Type F-120 Oil Circuit breakers—both must possess not only strength but speed, stamina, and agility, and all of these in superior measure. Condit's new Type F-120 leads the field as the result of many years' experience in design and building of heavy duty oil circuit breakers.

For full information,

"*Get in touch with Condit*"

CONDIT ELECTRICAL MFG. CORPORATION
Manufacturers of Electrical Protective Devices
BOSTON, MASS.

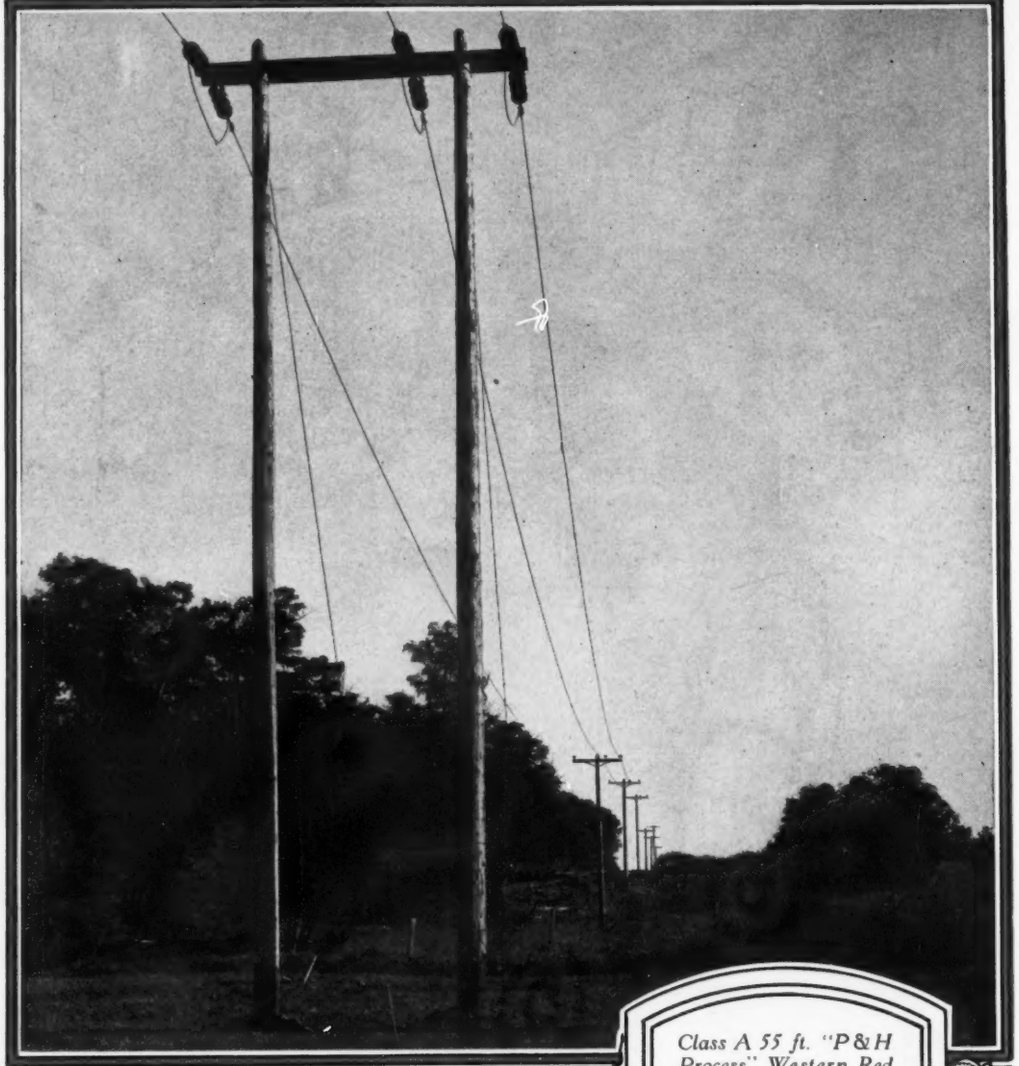
Northern Electric Company
LIMITED
Distributor for the Dominion of Canada

Specifications: Ampere capacity 3,000 or less; voltage 15,000 or 25,000; interrupting capacity 1,000,000 kv-a or less.

CONDIT

2249

P&H



Class A 55 ft. "P&H Process" Western Red Cedar Poles in transmission lines of New York Power and Light Corporation near Albany, N.Y. Present voltage 13,200; ultimate capacity 33,000 Volts. Average Span 185 feet.

"P&H Process" Poles- individualized by six distinctive features

1. Extraordinary care in the selection and purchase of our timber to secure sound, healthy cedar.
2. Seven separate and exacting inspections of every "P & H PROCESS" Pole.
3. Checking eighty-five points during the seven separate inspections—of which seventeen are tests of the creosote oil.
4. A distinctive type of power-driven perforating machine of our own design and patent.
5. The perforating of the pole under a spray of water. A P & H Patent.
6. A clean-cut, written guarantee of the Butt-Treating Results with every shipment of "P & H PROCESS" Poles.

"P & H PROCESS" Poles are the choice of those well managed companies which believe that low per annum cost is more important than low first cost.

Complete service and prompt shipment on all cedar pole needs—Northern White Cedar or Western Red Cedar.

"Still in the Lead"

PAGE AND HILL CO.

MINNEAPOLIS, MINN.

New York, N. Y., 50 Church St. Chicago, Ill., 19 So. LaSalle St. Dayton, Ohio, 854 Reibold Bldg.
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Ad No. 2817

Screw Brackets

3700-*P*

3600-*P*

3719-*P*

A service attachment with no metal part exposed to cause rust stains on a building. Brackets 3700-P and 3600-P have screw held by lead imbedded under pressure into traverse recesses. No turning or tearing loose. The screw of No. 3719-P is held in place with alamalakite instead of lead. Approximate strain—1200 to 1800 pounds.

Send for Bracket Catalog No. 104.

High Tension Combinations

The standard units upon which combinations are based are Choke Coils Disconnect Switches and Fuse Mountings. By using these units it is possible to have a combination of the three or of either one with another.

These combinations are made in all the standard voltages and amperages for either upright, inverted or vertical mounting.

Disconnect Switch and Choke Coil.

Send for High Tension Catalog No. 108.

BLACK & WHITE
Ask our Salesman
LINE
We make what you want made

Low Tension Bus Bar Supports

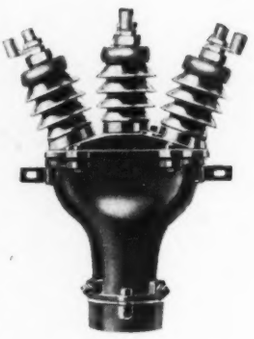
Type R-P.

Bus Bar Support—The round type clamp is designed for buses or cables. The pipe base can be furnished for standard sizes of iron pipe from ¾″ to 2″. Insulators are wet process porcelain. Base and clamp are interchangeable with many other types. Solve your difficult problems in bus bar wiring by using interchangeable units.

Send for Low Voltage Bus Support Catalog No. 109.

Potheads

Three conductor outdoor Pothead—Flad straight type—angle bushing. Most popular of our Pothead line. This type may be had with 2, 3 or 4 conductors for outdoor service; and with 2, 3 or 4 conductors, upright or angle bushings, for indoor service. For special mountings and special cable entrances and exits we have other types of bodies.



Flat Straight Type.

Send for Pothead Catalog No. P-100.

Complete Line—One Order—One Source—One Service

Fuses	Ornamental Street Lighting Fixtures	Racks
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Potheads	Overhead Street Lighting Fixtures	Specialties
Oil Switches	Cast Iron and Concrete Standards	Choke Coils
Fiber Conduit	Insulated Lamp Hangers	Bus Bar Clamps
Pole Top Switches	Street Fixture Brackets	Bus Tap Switches
Underground Racks	Transformers	Pole Line Hardware
Pole Top Combinations	Break Arms	Underground Accessories
High Tension Combinations	Mast Arms	Low Voltage Bus Supports
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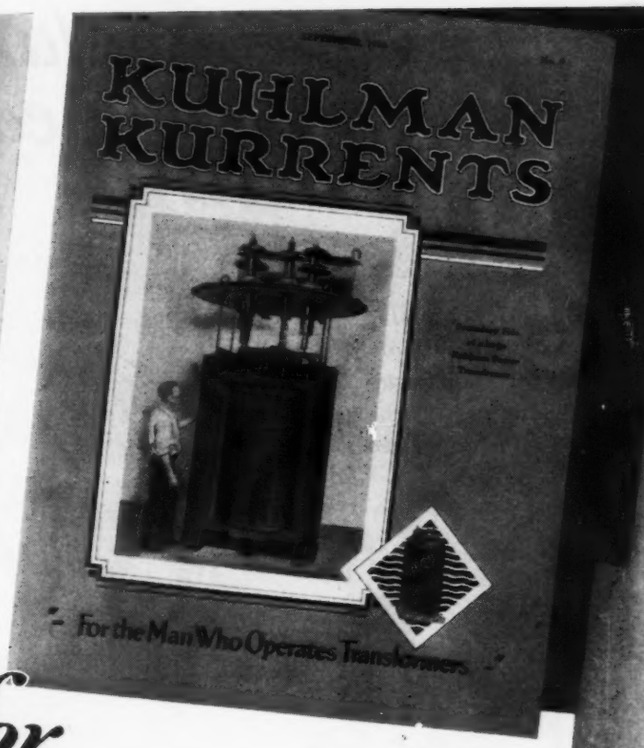


for
the engineer
who is responsible for transformer installation and operation

Letters received daily indicate that Kuhlman Kurrents is a real help to a large number of engineers, executives, and others who are concerned with the installation and successful operation of transformers. A few subjects discussed in recent issues are:

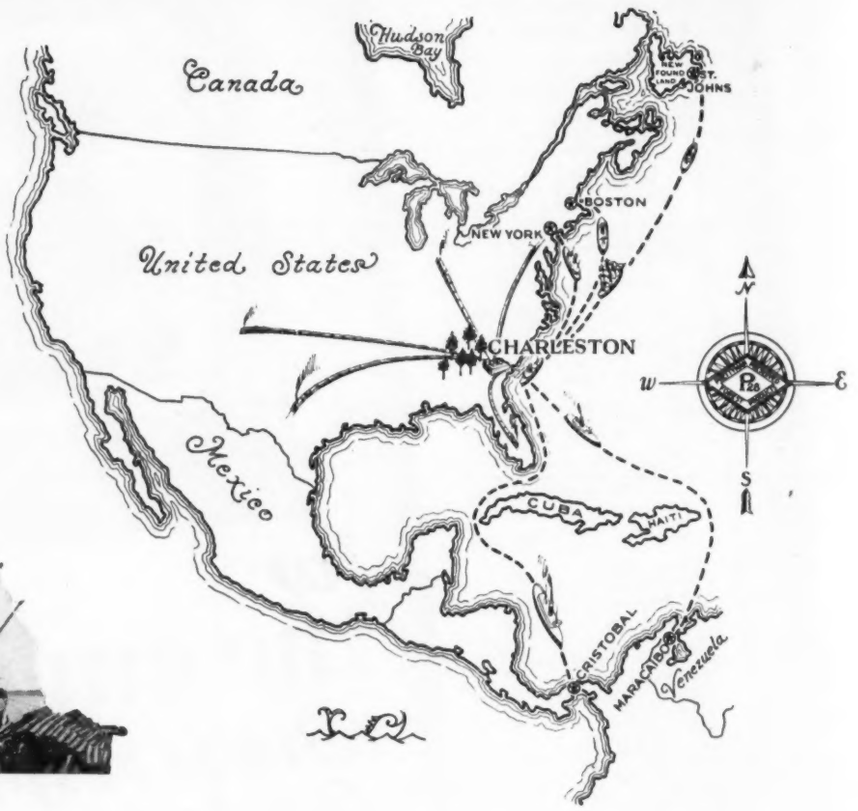
Grouping Dissimilar Transformers.
Ventilation of Transformer Rooms and Manholes.
Transformer Fundamentals.
Repair Versus Replacement of Old Transformers.
Are your Transformers Overloaded?
Keeping High-Tension Transformer Records.

If you are interested in receiving Kuhlman Kurrents, write to the nearest office on your company letterhead.

KUHLMAN TRANSFORMERS
KUHLMAN ELECTRIC CO.
BAY CITY MICHIGAN

From New Foundland to Venezuela
Prettyman Quality earns Confidence

*"If a man can write a better book, preach a better sermon, or make a better mousetrap than his neighbor * * * the world will make a beaten path to his door."*



ST. JOHNS! Cristobal Maracaibo! Up and down the three Americas, in one short year, Prettyman quality and service have won consumer acceptance . . . good will . . . confidence. No romance of industry, this. No tale of magic marketing methods or far-flung exploitation. Just honest quality and service. Dollar for dollar value in Prettyman Preserved Timbers, Ties, Poles and Piling. Quality Southern Pine, efficiently impregnated with high grade creosote oil to prevent decay.

In the twelve months since this complete and modern plant made its first shipment, it has made friends and customers of many of the biggest and most careful buyers on the continent. The United States Government. The Pennsylvania Railroad. The Canadian National Railways. The Southern Railway System. The Standard Oil Company. The Postal Telegraph and Cable Company. The Gulf Refining Company. The Sinclair Refining Company. The United Gas Improvement Company. The Southeastern Power Company. The Potomac Electric Power Company. State highway departments. And hundreds of others.

J. F. Prettyman & Sons will continue to deserve this confidence.

J. F. Prettyman & Sons
Wood Preserving Plant
Charleston, S. C.

To be specific—

Some features you should know about in the

S & C
High Potential
Fuse

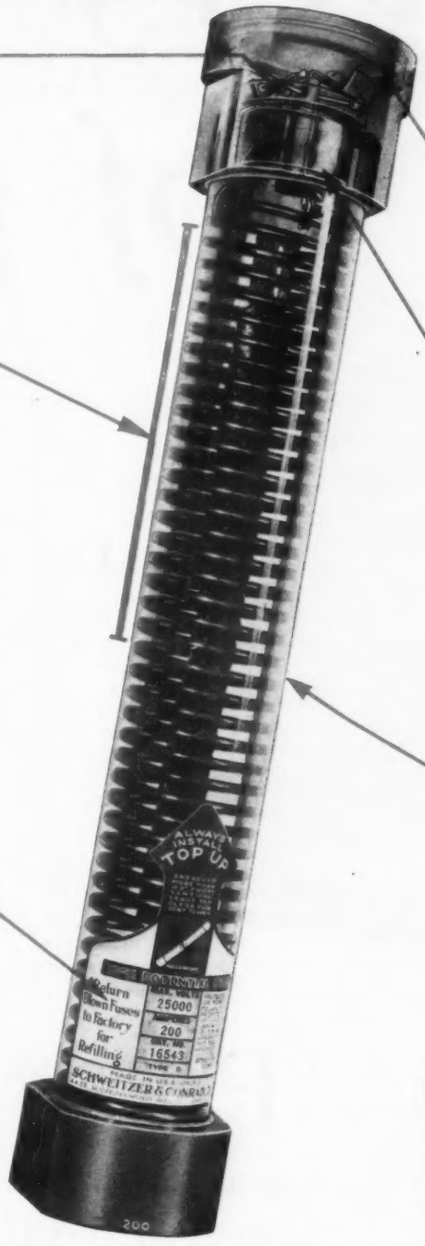
Fuse Element of accurate rating and dependable time-current characteristics.

Collapsing of coil spring forms a definite gap over which the arc will not re-establish.

Due to this spring the interrupting action is always rapid regardless of the amount of current melting the fuse element.

Return of blown fuses to the factory for refilling is your protection.

It wipes out all depreciation and insures the original reliability.



Vent cap relieves pressure when fuse blows during a short-circuit.

Liquid director sends a stream of high dielectric non-inflammable liquid into and around the arc, effectively quenching it.

Transparent Glass Tube through which a blown fuse is readily distinguishable at a distance—a big time saver in a critical moment.

Used outdoors as well as indoors. Liquid does not freeze or congeal.

Lowest cost fuse protection because it is the most effective and because of practically no depreciation in original investment.

High Interrupting Capacity—higher than any but the most expensive oil circuit breaker.

Most Dependable protection for all high voltage lines or equipment.

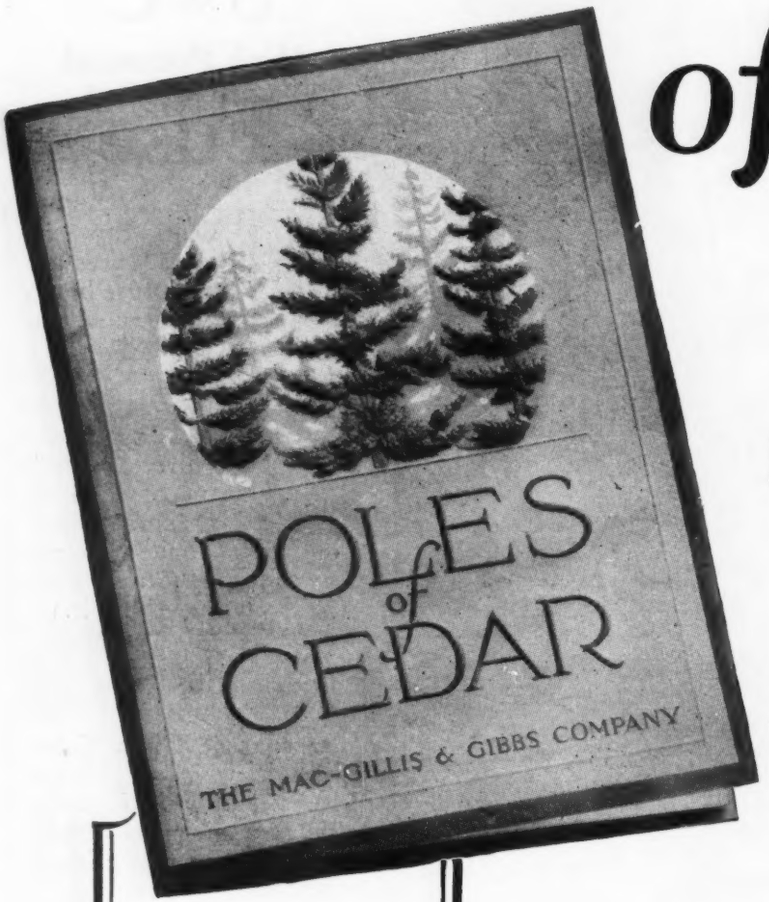
SCHWEITZER S&C CONRAD, INC.

4435 RAVENSWOOD AVENUE CHICAGO, ILLINOIS U.S.A.

Boston, New York, Philadelphia, Buffalo, Pittsburgh, Charlotte, Detroit, Cleveland, Birmingham, Minneapolis, St. Louis, Kansas City, New Orleans, Omaha, Denver, Dallas, Seattle, San Francisco, Los Angeles

Japan, T. Hasegawa Co., Osaka

To every user of poles!



Do you know the role Science plays in your pole requirements?

Your copy is ready!

"POLES OF CEDAR" is an accurate and scientific treatise on poles and their preservative treatment . . . . . It will render great assistance to any utility engineer or purchasing agent, and will prove of extraordinary value as a standard reference manual.

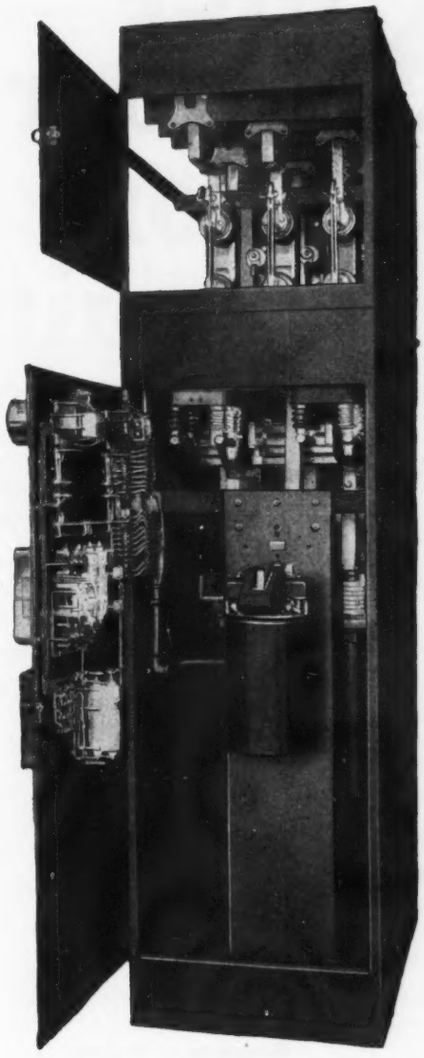
The MacGillis & Gibbs Company

120 East Wisconsin Avenue
Milwaukee, Wisconsin

New York City—220 Broadway

Automatic Reclosing Feeders *under cover*

Automatic a-c. reclosing feeders operate with greater efficiency when dust and dirt are excluded from the equipment. For indoor installations where certainty of performance is essential, or where safety requires special precautions, General Electric now offers the reclosing feeder cubicle.



These standard features are found in all sizes of G-E cubicles:

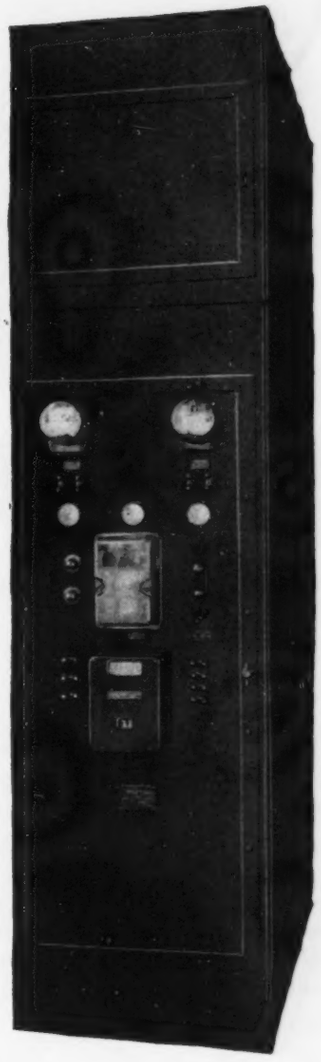
Units are easily installed and occupy minimum floor space.

All wiring is easily accessible on the back of the front door.

A universal support is used, drilled to accommodate several types and sizes of oil circuit breakers and mechanisms.

A rear door affords means of conveniently inspecting breakers and all breaker parts.

These cubicles, rated up to 7500 volts, can be set side by side to form a continuous switching equipment.



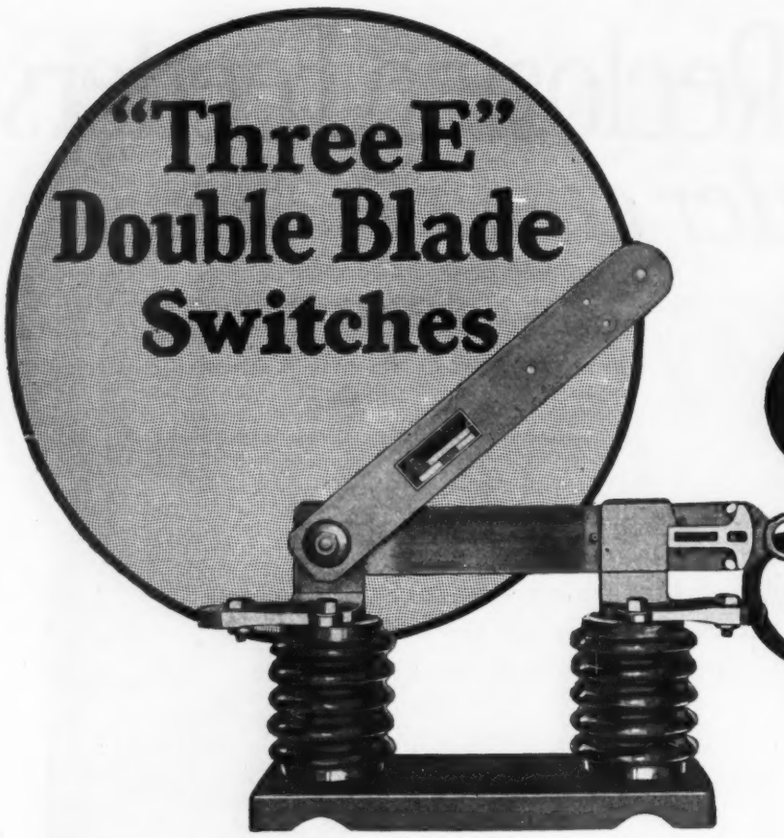
Your purchase of G-E automatic switching equipment is your assurance of a permanent source of renewal parts and the services of a nation-wide organization of specialists. For complete information on this type of equipment, refer to the nearest G-E sales office.

460-31

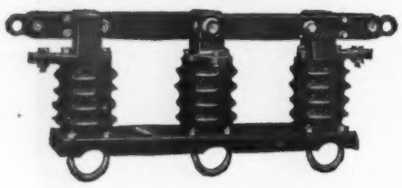
GENERAL ELECTRIC

GENERAL ELECTRIC COMPANY, SCHENECTADY, N. Y., SALES OFFICES IN PRINCIPAL CITIES

"Three E" Double Blade Switches



Safer under short circuits



Other Features

Cooler operation.

Greater capacity with a given temperature rise.

Absolutely true contact.

A more lasting contact.

Perfect contact always secured after a given time of usage, by simple adjustments.

Minimum maintenance.

Elimination of ordinary troubles.

Stands a heavier short, or an ordinary short, longer than switches of single blade design

because of a combination of features in design such as double blades, ground-in contacts, and heavy locking bolts. This safety feature can be depended upon because "Three E" Double Blade Switches in service everywhere are conclusive proof. Our engineering department will be glad to consult with you on your switch problems. The Service Value* of "Three E" Equipment is worth investigating.

* "Service Value" = Low cost per year of service

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It Pays to use the THREE E *Catalog*

Stop Thief!

FROM New England---Ohio---Mississippi---Arizona ---California---Mexico---Panama---and places in between---come reports of the serious ravage of untreated poles in power transmission and telephone lines, by subterranean and non-subterranean termites (white ants).

These little insect pests, by their boring, steal from the bearing strength and are one of the costliest enemies of pole lines. Since termites migrate, infected areas are increasing, and serious damage is often done even before they are suspected.

How to Stop Losses from TERMITES

Every purchaser and user of poles should know about the habits of both subterranean and non-subterranean termites and how best to combat them so as to prevent serious and unexpected service interruptions and losses.

In a recent issue of Electrical West, there appeared an article on termites by Dr. Thomas E. Snyder, Entomologist of the Bureau of Entomology, U. S. Department of Agriculture. Under the heading "Termite Pole Damage in California," Dr. Snyder presents the results of much study on this subject, and certain conclusions and recommendations which should interest every user of poles.

Termite Pole Damage in California

By Thomas E. Snyder

A WOODEN pole used for telephone, telegraph, electric light or power service is surely to decay or rot just as is a dead tree. Hence it is subject to attack by wood-boring insects and sprouted dead tree with roots and bark removed. tree. Poles in general formerly were not treated with chemical wood preservatives, as now is almost universally necessary for proper protection from wood-boring insects and wood-destroying decay. The termite or white ant is one of the most destructive types of insects which damage and destroy poles.

HAVING recently completed an extensive personal survey of the termite ravages in the California area, Dr. Snyder presents interesting information regarding termites themselves and discusses upon various methods of protecting against termite inroads.

Get A FREE Copy!

With a view of the benefits which will come to power transmission and telephone industries (of which we consider our organization an integral part) through better knowledge of the "Termite problem---and its solution," we have had a number of reprints of Dr. Snyder's article made. One or more copies of this interesting and informative treatise will be sent without cost to any one requesting it.

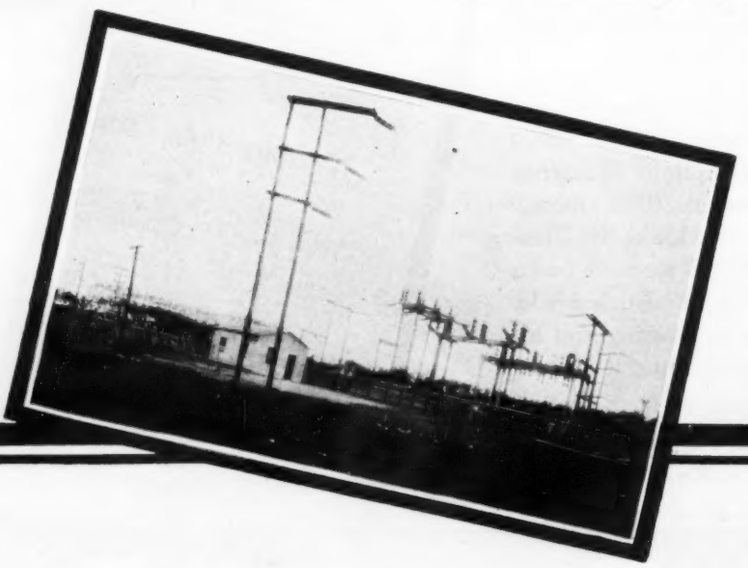
TEXAS CREOSOTING COMPANY
Main Office & Plant: Orange, Texas, U. S. A.

"Black Beauty" Poles

AMCRECO -POLES- *are*

THERE is nothing temporary about an Amcreco Creosoted Southern Yellow Pine Pole. These full length pressure treated poles are selected by leading utilities for classes of service where only the highest type of construction is good enough. The effective diameter of the new Amcreco pole shown at the right above will not be reduced as was that of the old untreated pole which is being replaced. Amcreco poles resist decay for 35, 40 and more years. The pure creosote oil used in these poles is unsurpassed for its practical value as a wood preservative. Similarly, no better method of impregnating poles with creosote oil has ever been developed than the Lowry process used in all Amcreco plants.

Not only does this creosoting process protect these poles against untimely decay—it also renders them highly resistant to other deteriorating influences. Poles are often weakened by repeated grass fires. The oil in a



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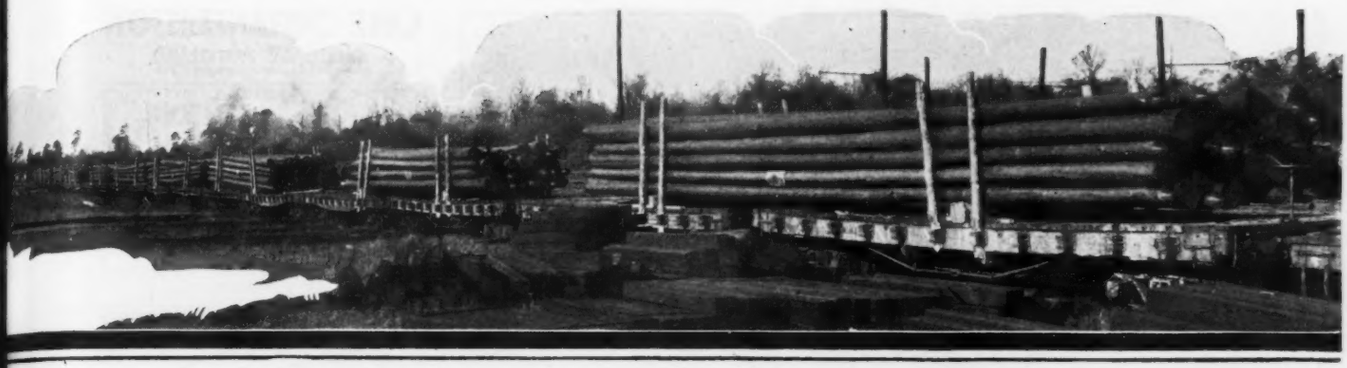


permanent poles

creosoted pole prevents the wood from burning freely. The surface is soon charred and further combustion is stopped before the pole is seriously damaged. The oil renders the wood "toxic" to white ants or termites in the same way that it does to decay producing fungi. It is also repellent to woodpeckers.

Since Amcreco poles are protected against the ordinary processes of deterioration, they maintain their high original strength through their long life. This high maintained strength gives them an added feature of permanence because they are able to withstand the severe wind, sleet and ice loads which annually take such heavy tolls of untreated poles. Every big storm of recent years has added conclusive proof of this superiority of creosoted southern yellow pine poles.

For permanence, specify Amcreco. Let us give you quotations on your requirements.

AMERICAN CREOSOTING COMPANY

INCORPORATED

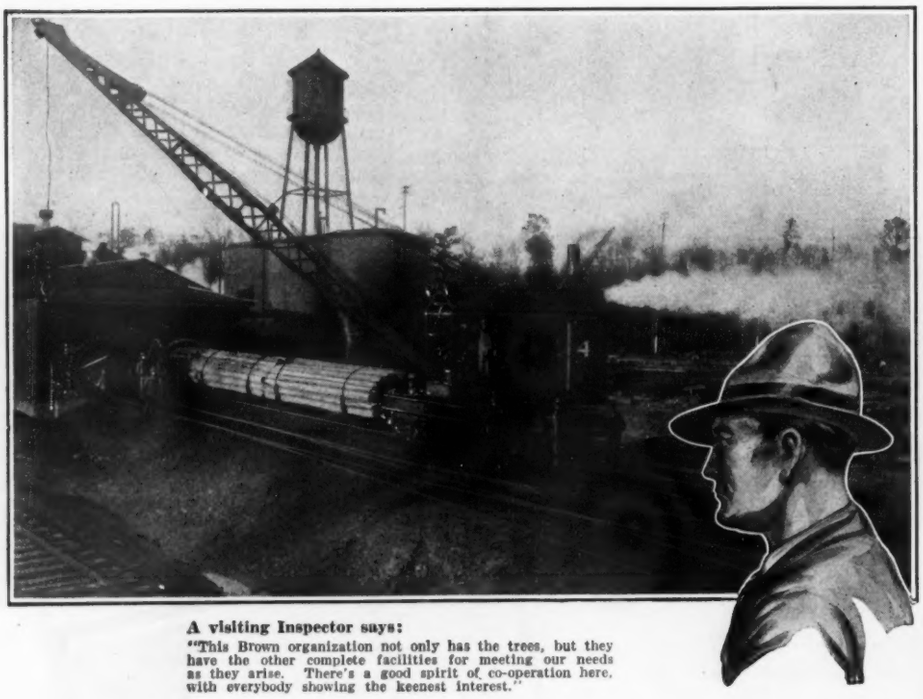
COLONIAL CREOSOTING COMPANY INCORPORATED

AMCRECO LOWRY PROCESS CREOSOTED WOOD

GEORGIA CREOSOTING COMPANY INCORPORATED

LOUISVILLE ~ KENTUCKY

EW9-29Gray



A visiting Inspector says:
"This Brown organization not only has the trees, but they have the other complete facilities for meeting our needs as they arise. There's a good spirit of co-operation here, with everybody showing the keenest interest."

"Headquarters for Creosoted Poles"

To give the Central Station industry what it wants in creosoted poles when it wants it is rendering a service that soon earns the gratitude of the pole-buyers in this field. We believe this is why more and more of these men are turning to BROWN as "Creosoted Pole Headquarters."

For the BROWN organization is situated to offer a unique service. It is in effect a pole-producing machine co-ordinated throughout for producing, cutting, transporting, and treating the poles, and operating as one organization.

The BROWN holdings of Dense Southern Yellow Pine are ideally located, the treating plant,—one of the most modern in the country,—being nearby. Rail lines run directly into the timber and the cut poles are loaded on railroad cars by locomotive cranes. Throughout these operations only this company's equipment and crews are employed.

This one-profit method of operation insures not only lowest of operating costs, but ease and speed of handling, and the maintenance of quality.

Have you details of the BROWN "new deal in poles"? Write or 'phone.

Address all communications to Creosoting Department of the

W. P. BROWN & SONS LUMBER CO., INC.

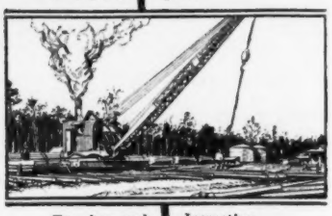
Fourth and K Streets, Louisville, Kentucky

Telephone: Magnolia 2407

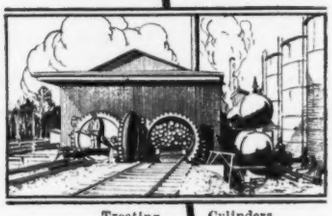
ONE ORGANIZATION
straight through

Forest | Operations

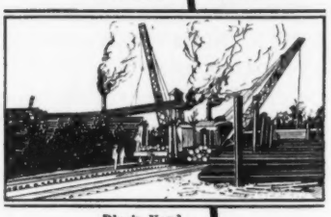
En route to | plant



Framing and | Inspection



Treating | Cylinders



Black Yard

Finished Product—Outbound

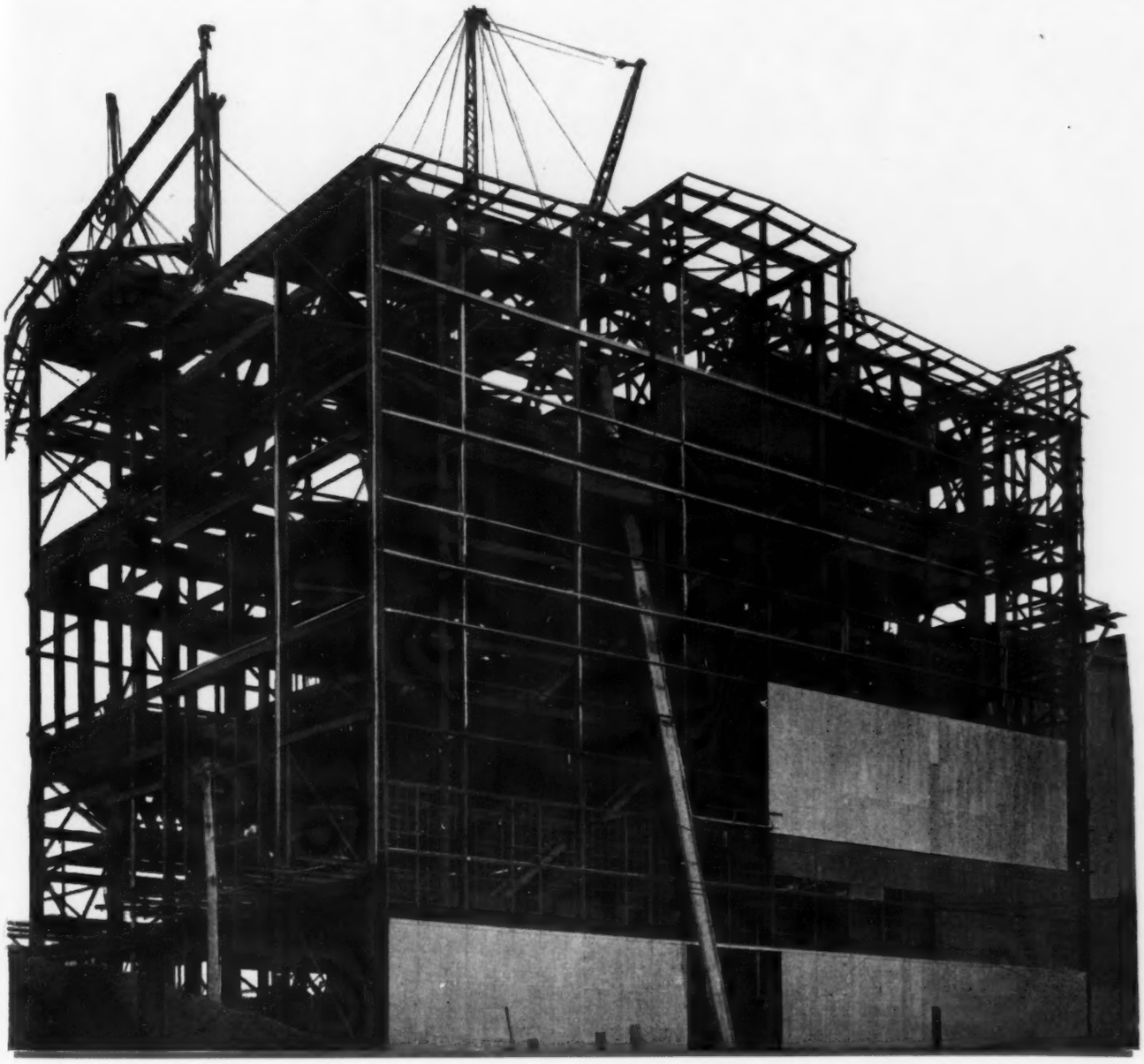
Producing operations and treating plant at Brownville Alabama

BROWN

CREOSOTED YELLOW PINE PRODUCTS

300,000 Acres One of the largest

Individual Holdings in America



Look at the Steel!

A MASS of solid steel in this boiler house—twice as heavy as any ordinary office building of the same dimensions. Great strength was necessary with a limited space and therefore steel was selected. It is the boiler house of the new Long Island Lighting Co. station at Glen Head, L. I.; 1,700 tons of Lehigh Steel were used in this one building alone, representing a unique, modern boiler house construction.

In addition the turbine room, electrical bay transformer house and switching station were all built of Lehigh Steel, giving a total of over 3,000 tons in the one station.

Specify Lehigh Steel for power plants, coaling stations, substations, transmission towers and any building construction.

LEHIGH STRUCTURAL STEEL COMPANY

ALLENTOWN, PA.

New York Philadelphia Washington Boston

2983

UNINTERRUPTED SERVICE

International Creosoted Pine Poles in signal service on the Big Four near Indianapolis, Ind.

EFFICIENT and reliable power transmission service requires poles which are uniformly strong, durable, economical, and free from failures.

These requirements are most ably filled by ***International*** Creosoted Pine Poles. They possess greatest permanent strength and stand up in emergencies where others fail.

Proof of this permanency is the test of time and ***International*** poles have passed this test most successfully. They have been in service 28 years through wind and weather and are still in excellent condition.

With this service record and with ***International's*** firm operating policy to produce only quality poles, uninterrupted service is assured, insofar as it depends on poles.

International Creosoting & Construction Co.
General Office: Galveston, Texas

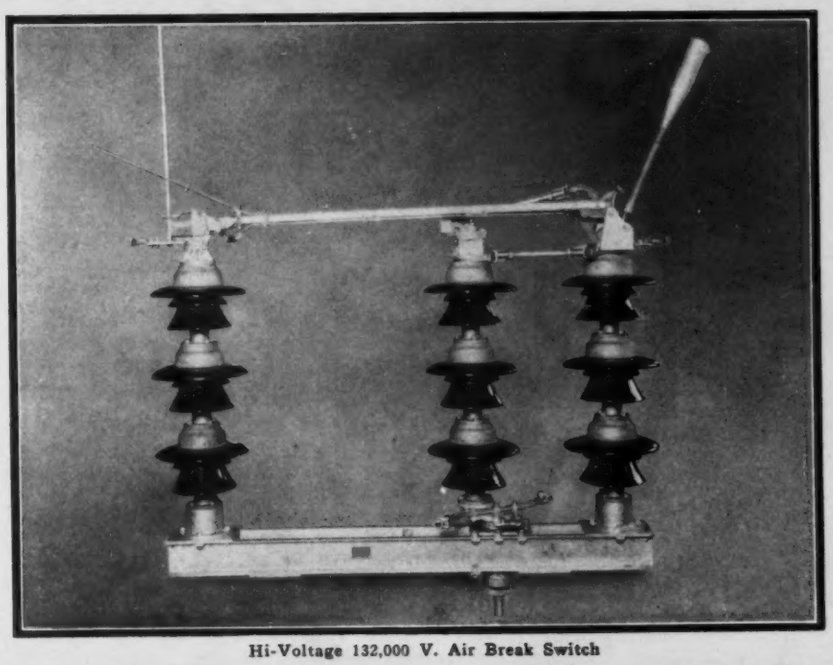
Distributed by Graybar Electric Company

International
Creosoted Yellow Pine Poles

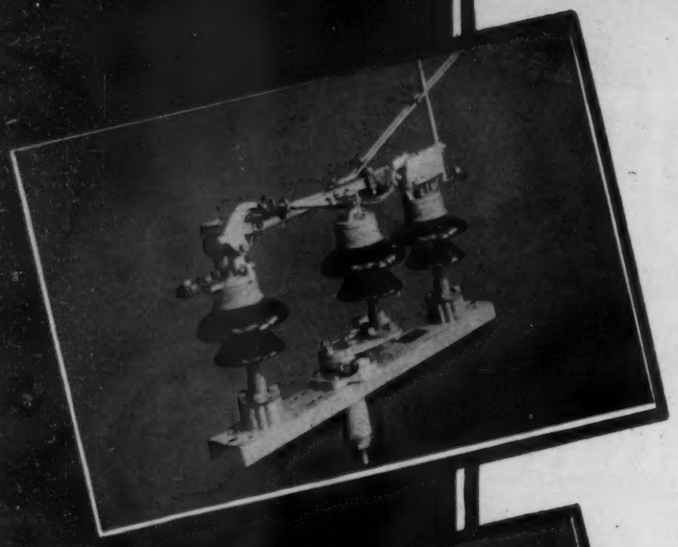
HI-VOLTAGE

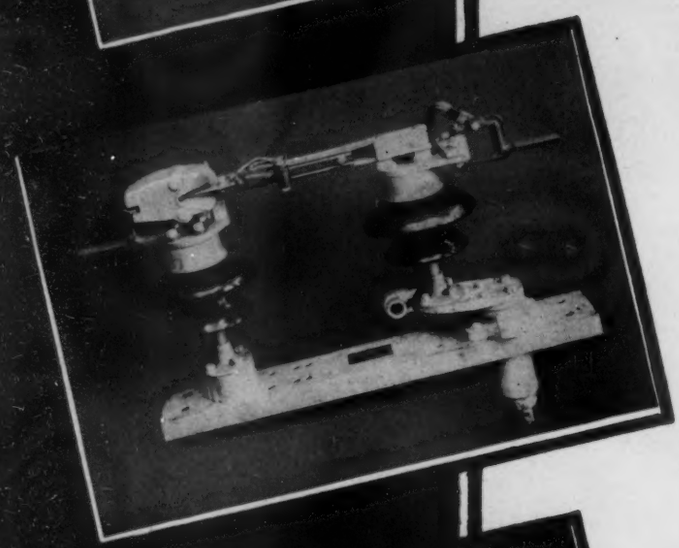
"Hi-Voltage Switches Go Up

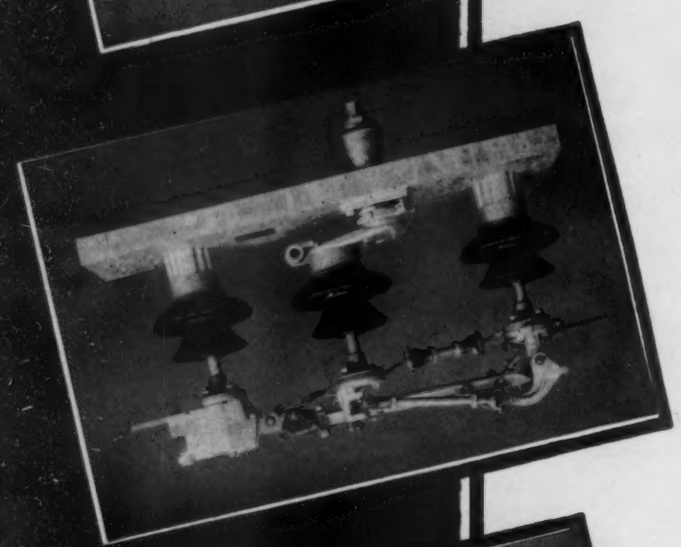
The Quickest of Any We Ever Installed"

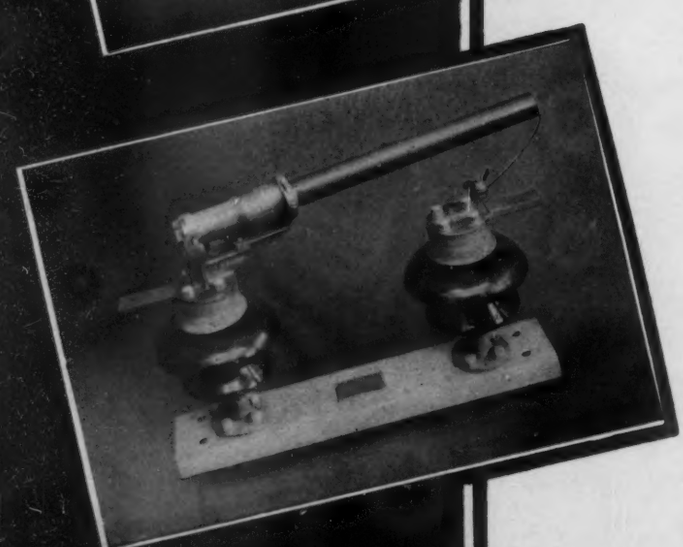


Hi-Voltage 132,000 V. Air Break Switch









HI-VOLTAGE

"Hi-Voltage Switches Go Up the Quickest of Any We Ever Installed"

REPEATEDLY, this statement has been made by engineers and field crews—and it is an echo of a policy we have held since we began business.

It has always been our contention that the price of a switch on the freight car means nothing. The real price—the one you must finally pay is the cost of the switch installed.

Hence, we have always pursued the practice of so building our Switches, Fuses, etc., that installation work will be just as little as possible.

Every piece of Hi-Voltage Equipment is shipped, completely assembled in a crate. All possible work is completed in our shop where it costs little, instead of in the field where it is expensive.

Operating mechanism is equally complete, and as easily assembled. Where switches are mounted on steel work, or where complicated offset or indirect controls are necessary, we recommend our hexagon shaft mechanism. The shaft is mounted in monel ball bearings and assembled with clamp type fittings. We ship such mechanism with all bearings in place. All drilling is done. Assembly is merely a matter of placing the clamps and bolting up—no field drilling necessary. The completed mechanism will have no lost motion.

If you will write us, we will give you specific instances of economy in this respect.

Hi-Voltage Air Break Switches, Gang and Hook Disconnect Switches, Fuses, Choke Coils, Bus Supports, Connectors and kindred equipment have made outdoor substation history.

If you do not now have our complete catalogue, send for it at once.

Hi-Voltage Equipment Co.

CLEVELAND, OHIO

Select Poles from Select Timber

LONG-BELL D-Z8

As evidence of our confidence and to identify the quality of Long-Bell Poles, each pole is branded with the above trade-mark with date and place of creosoting, five feet above the ground line.

Long-Bell Poles in a line of the Inter-State Power Company, Indianapolis, Indiana.

ONLY sound, live trees of great strength and straightness, which are free from injurious defects, are selected from the very heart of the Yellow Pine country for Long-Bell Poles. Every pole is then scientifically seasoned and pressure-treated full length with grade No. 1 creosote by the most effective and up-to-date methods. Long-Bell Poles resist decay and fire—serve for years at lowest maintenance cost. They are used in all types of construction.

Long-Bell's vast timber holdings assure large, well assorted stocks and prompt shipment. Write for full information.

The Long-Bell Lumber Company

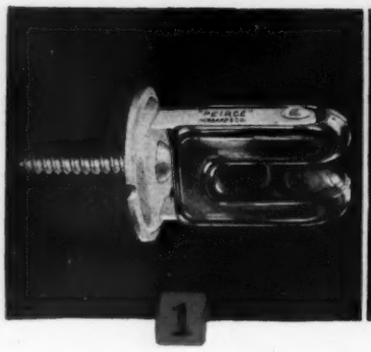
133 R. A. Long Bldg. Kansas City, Missouri

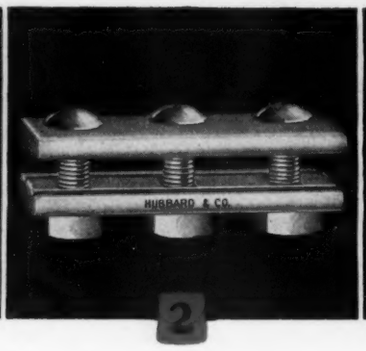
2018-A

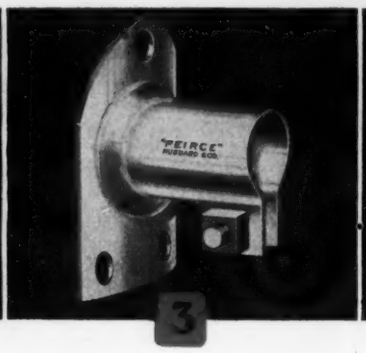
LONG-BELL

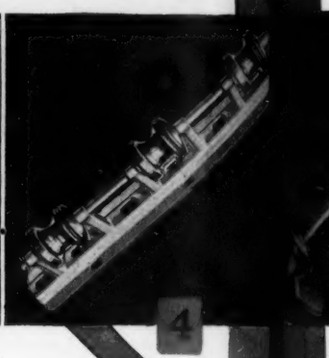
CREOSOTED *Yellow Pine Poles*

America's most modernized and CONSTRUCTIVE









1 **THE PEIRCE "190"**
Scientifically designed — metal in tension, porcelain in compression.

2 **HUBBARD GUY CLAMP**
Made from new hot rolled steel.

3 **PEIRCE POLE PLATE**
Pressed from steel — stronger than castings.

4 **PEIRCE SECONDARY RACK**
The strongest rack for its weight ever produced.

5 **HUBBARD STEELWING**
An anchor that goes in like a corkscrew.

6 **HUBBARD GUY GUARD**
Provides protection to the public. Saves 6 to 8 feet of guy strand.

7 **PEIRCE DETACHABLE POLE STEP**
Prevents unlicensed climbing. Safe for the public.

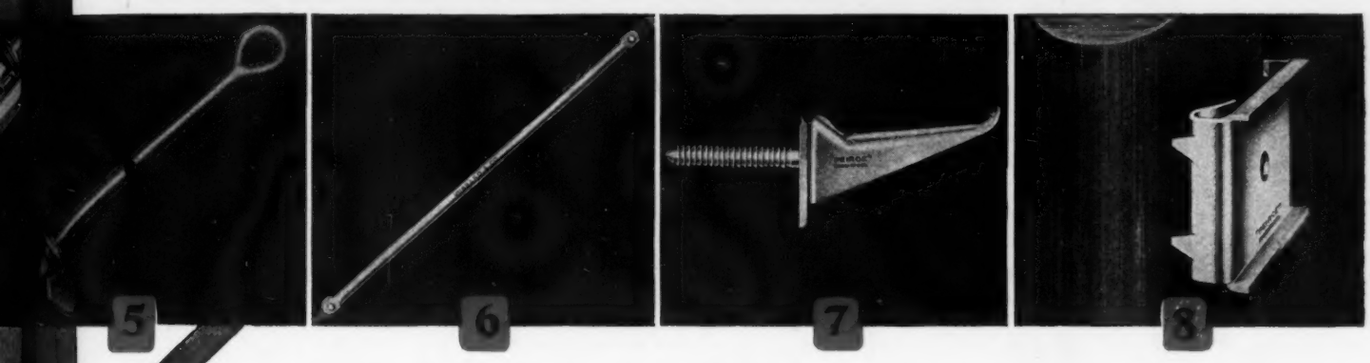
8 **PEIRCE POLE GAIN**
Made of presteel. Eliminates gaining the pole.

SEE ME EACH MONTH IN THE HUBBARD LINE BUILDER

John Lineman

Write to me at Hubbard and Company, 63rd and Butler Sts., Pittsburgh, Pa., and I will see that you receive my personal message every month.

POLE LINE HARDWARE
CTION SPECIALTIES



Manufactured by Hubbard and Company

MARK TWAIN once said:—"Everybody complains about the weather but nobody does anything about it."

This statement is perhaps true of the period in which it was made but hardly so at the present time. There are few of the present day comforts that we are not able to enjoy in spite of inclement weather. At the touch of a button we produce light, heat, music and pictures. We are able to see and hear distant events without leaving our favorite armchair. So something has been done "about the weather," not to improve it exactly, but to make its effect upon us less noticable.

The part that Hubbard plays in this picture of modern comforts and conveniences is highly important. America's most modernized Pole Line Hardware functions silently and faithfully "in spite of the weather" to support thousands of miles of lines carrying electric power in all parts of the world.

Hubbard and Company, in furnishing pole line hardware and Peirce Construction Specialties, has been setting the pace in its field for decades with new designs not only in the articles manufactured, but in line construction itself, as for example, the modern system of vertical distribution in secondary wiring.

Hubbard Hardware and Peirce Construction Specialties are protected from the elements by a heavy coat of zinc applied by the hot double-dip process. As long as the only claim for single-dip galvanizing is lower cost, Hubbard and Company will continue its rigid and unvarying use of the hot double-dip process, furnishing the lines with a hardware "BUILT TO ENJOY BAD WEATHER."

With three factories located at Pittsburgh, Chicago and Oakland, California, and stocks in the warehouses of 172 electrical jobbers scattered from coast to coast, Hubbard service has been developed to a degree of flexibility which provides instant results in times of necessity.

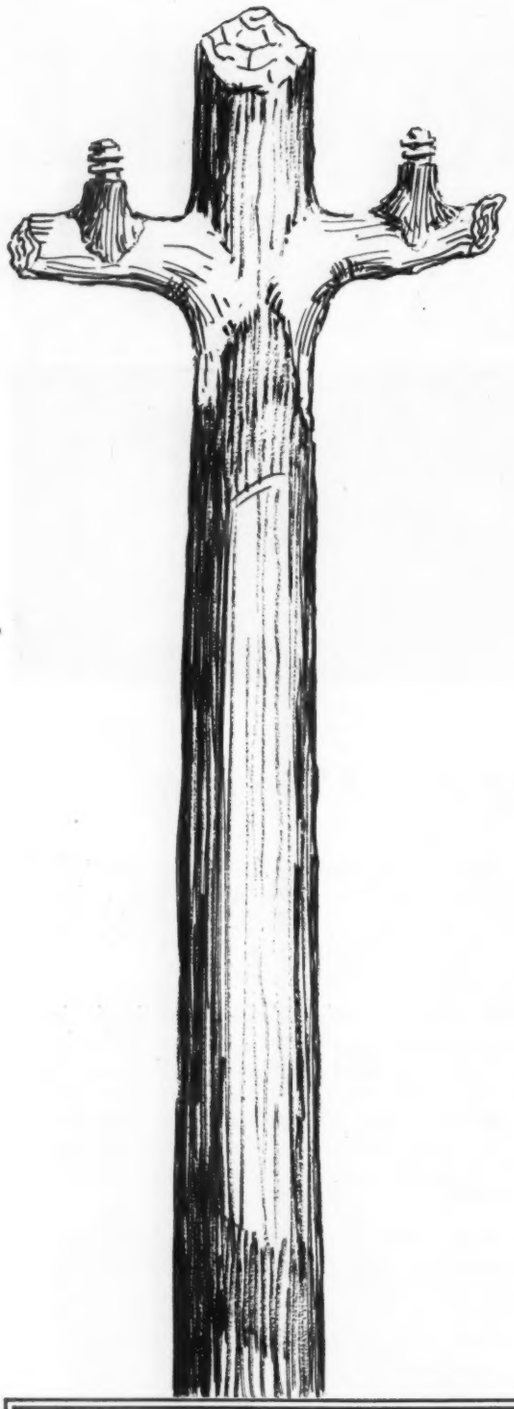
Carried in stock by 172 Leading Electrical Distributors.

—There is one near you.

HUBBARD

Hubbard and COMPANY

PITTSBURGH • OAKLAND, CAL. • CHICAGO



This is the ONLY way you can beat

PORTER & ROSS SERVICE

WHEN the art of tree surgery progresses to the point where they grow hybrid trees with trunks of Western Red Cedar—with branches to serve as cross arms of Douglas Fir origin—and with vertical shoots of Locust for pins—then and then only will there be a convenience service better than that offered you by

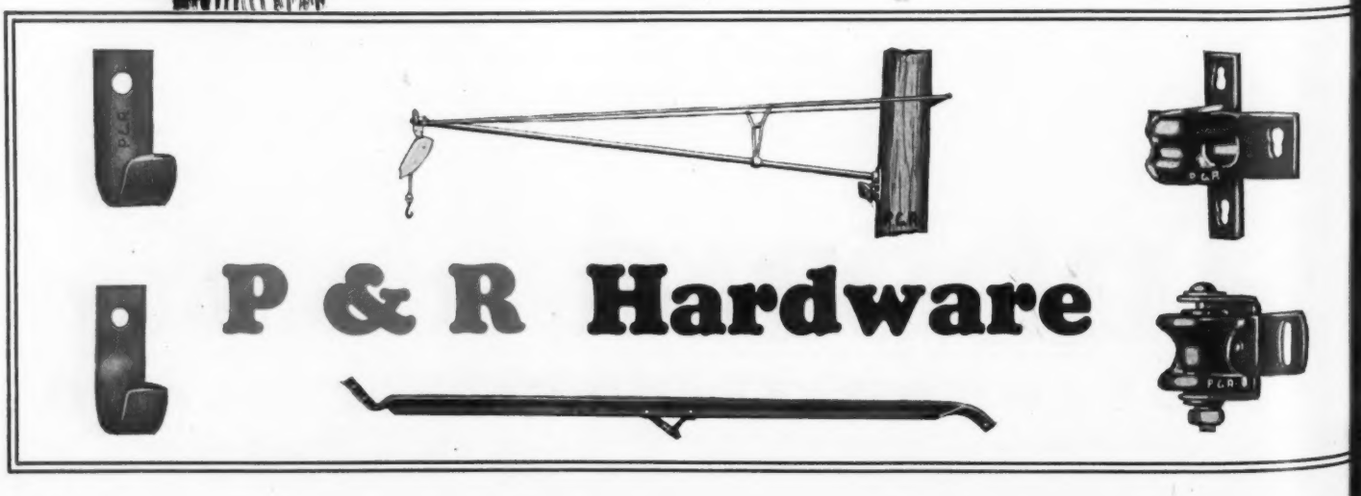
PORTER & ROSS, Inc.

30 Church Street . . . . . New York

—Factory at Third and Venango Sts., Philadelphia, Pa.—

—District Offices—

Monadnock Bldg. CHICAGO	*839 Oliver Bldg.* PITTSBURGH	*1002 Louderman Bldg.* ST. LOUIS
Texas Bank Bldg. SAN ANTONIO	*1318 Comer Bldg.* BIRMINGHAM	*176 Federal St.* BOSTON



P & R Hardware

The P&R Service presents this advantage when ordering material for a line:

P&R

See McGraw-Hill Engineering Catalog—1928 Pages 240-246

Turn to the P & R Catalog or to the McGraw-Hill Engineering Catalog (pages 240-246). Pick out the hardware you need and order it with the poles, cross arms and pins—and you get it all from the same source—the SAME responsibility.

POLES

Western Red Cedar

CROSS ARMS

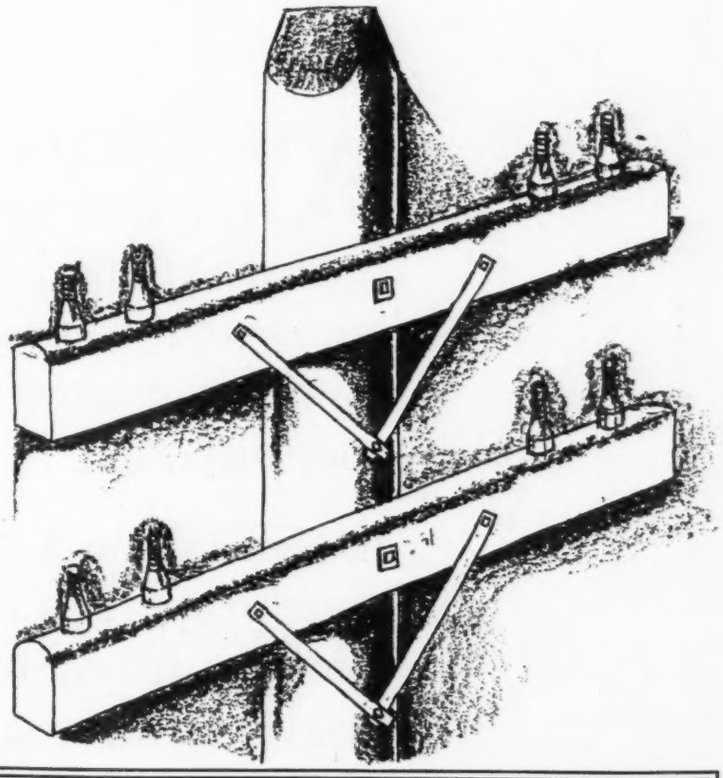
Douglas Fir

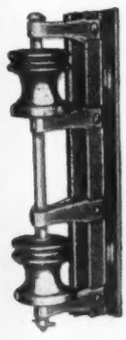
PINS

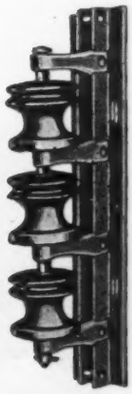
Locust

HARDWARE

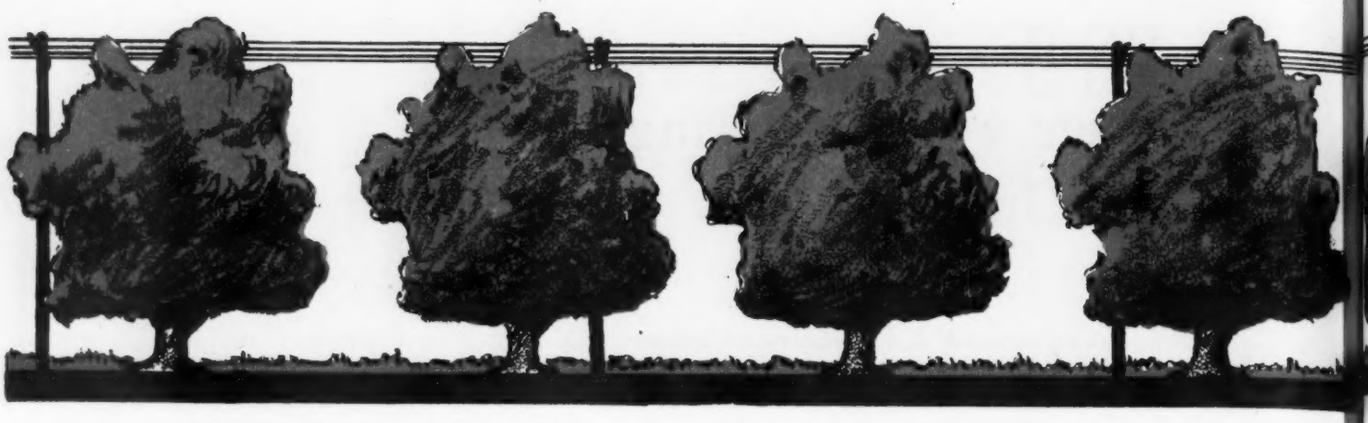
Hot Dip Galvanized







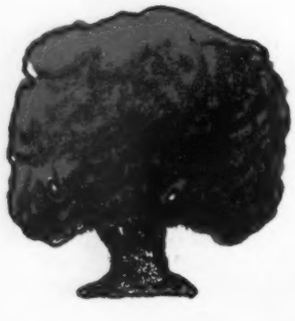
Monel metal furnished if desired



UNINTERRUPTED SERVICE AND

A TRAINED organization in line clearance work—one which has specialized and had ten years' experience in the promotion of uninterrupted service for power companies, is at your disposal.

A Nelson and Kuemmerling man on your properties insures good public relations, a thorough understanding of line clearance and freedom from service troubles caused by trees shorting and breaking lines.



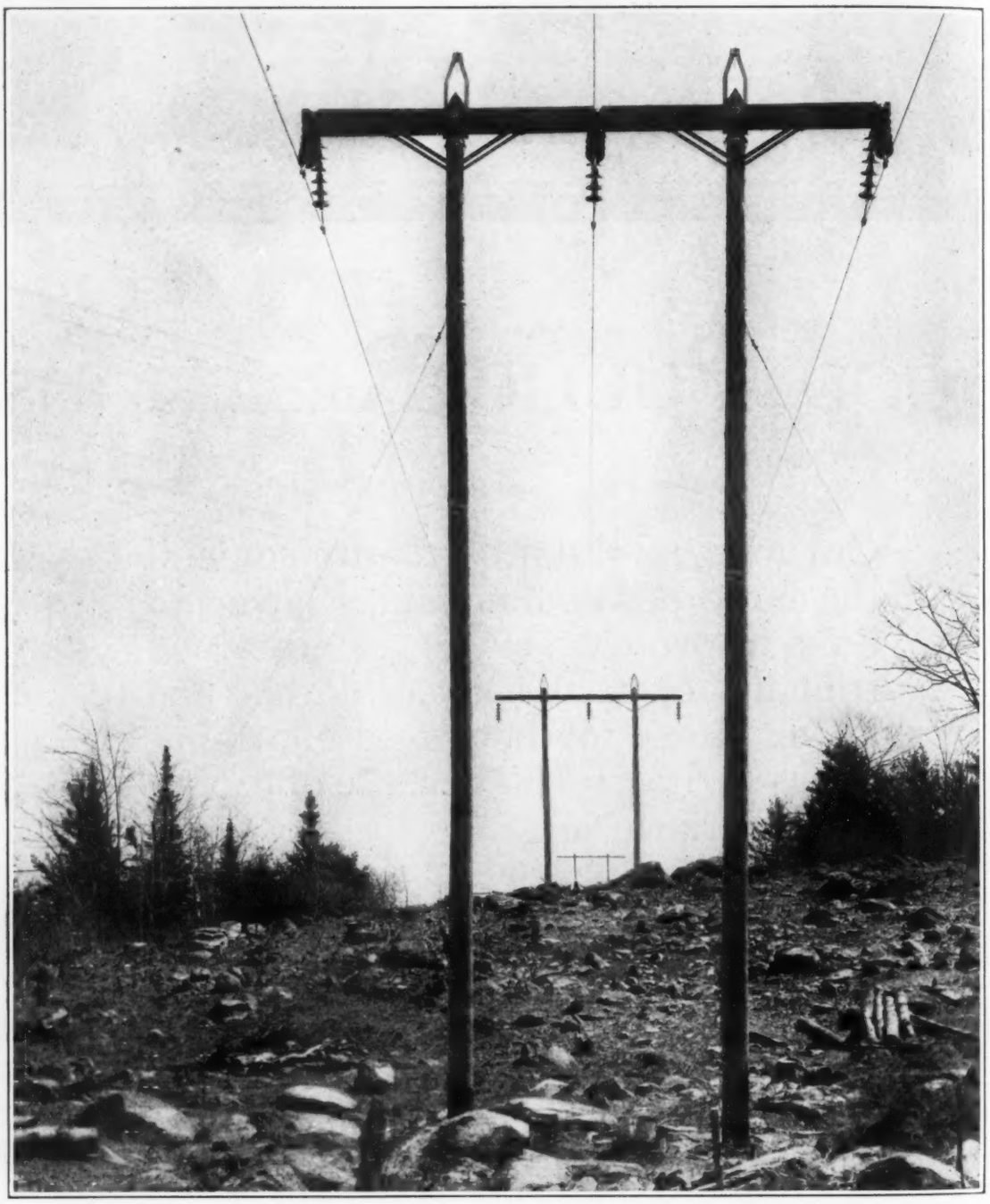
NELSON AND KUEMMERLING
CANTON,

GOOD PUBLIC RELATIONS

Our men, now stationed with some of the large power companies have not only improved service, maintained friendly relations between Public and Power Company but saved enormous losses during storms because of proper line clearance.

Let us talk to you about our proposition, what we do, how we do it and how it is of mutual benefit to both property owner and Central Station. Ask for a representative to call. There are no strings attached to this offer. Write today.

LINE CLEARANCE SPECIALISTS
OHIO



NAUGLE

When the first Central Station appeared on the scene

That was in 1882, when the first NAUGLE pole was shipped. Power transmission poles weren't in so great a demand as now. But today there is a network of distribution lines all over the country, giving countless cities and towns electrical energy.

With the phenomenal development of the electrical industry has come a demand for poles of particularly high standard. NAUGLE POLES have always met this standard, as evidenced by the fact that they have been successfully used in overhead transmission lines country-wide for 46 years.

The demand for good poles has been constantly on the increase, and NAUGLE stocks and facilities have grown with it. 150,000 to 175,000 poles of all sizes, well seasoned, are continually carried in stock for 24-hour loading. Butt-treatment plants of tremendous capacity right in our yards.

WESTERN & NORTHERN CEDAR
With or Without Butt-Treatment

NAUGLE POLE & TIE COMPANY
59 East Madison Street, Chicago, Ill.

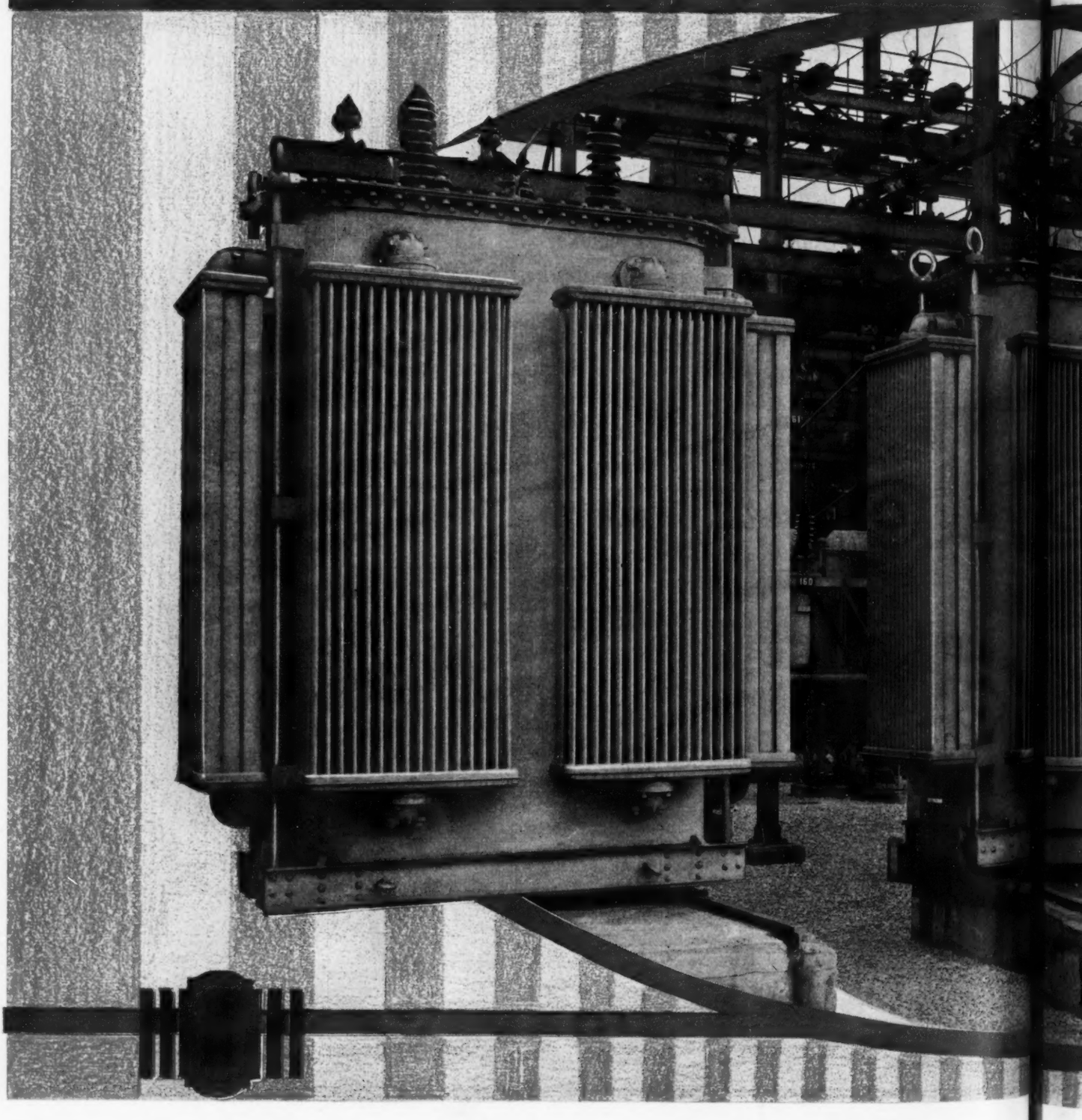
BRANCHES: New York, Columbus, Kansas City, Spokane, Vancouver, Boston
MAIN YARDS: •Minneapolis, •Pinconning, Mich., Vancouver, B. C., •Sand Point, Idaho, •Spokane, Wash.
•PENTREX machines and butt-treatment plants at these yards.

Super-Service on rush orders!

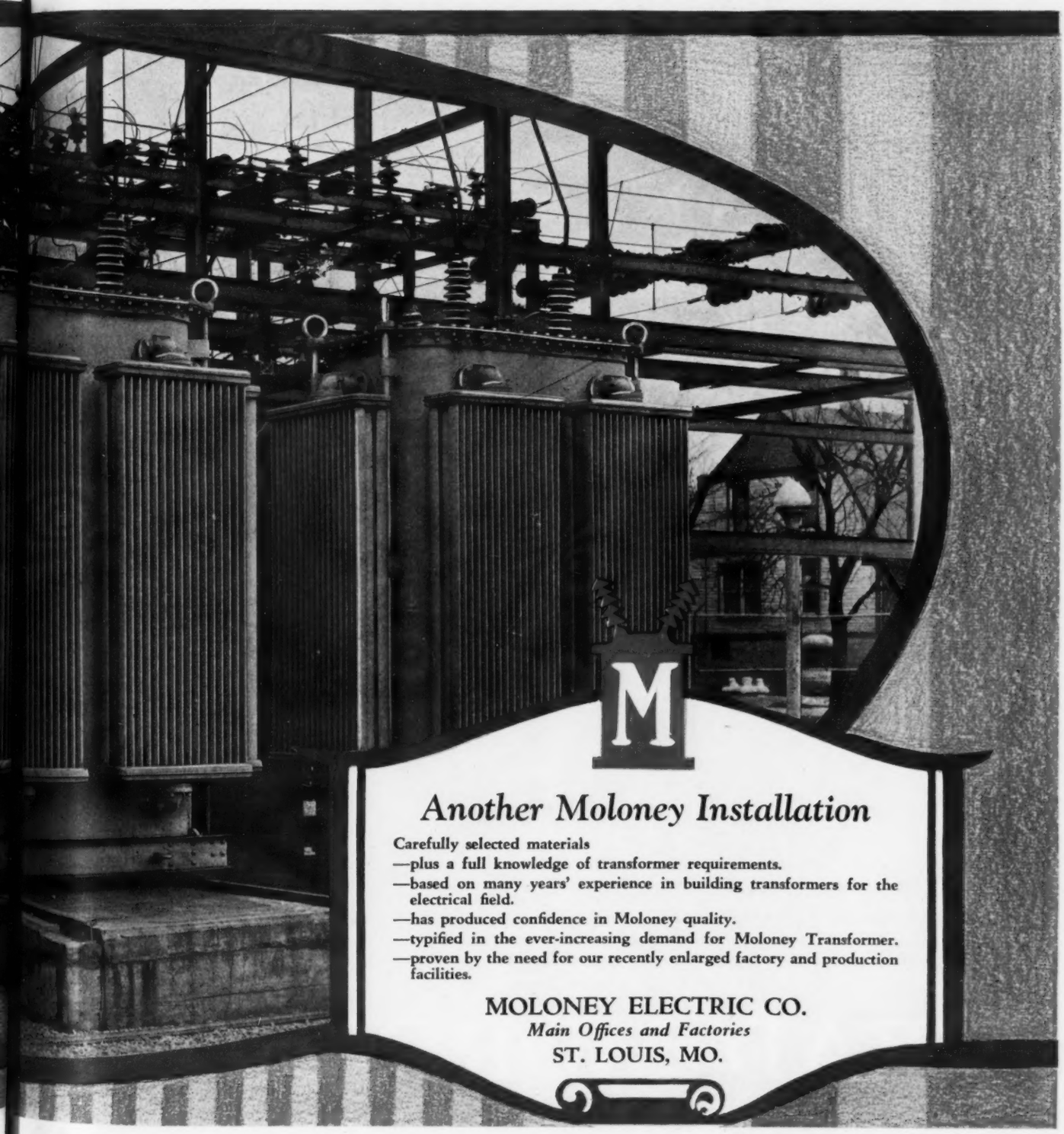
So well-directed are our efforts that if your order is received at 9 in the morning it can be loaded and on the way to you at 5 o'clock the same day. This service means much to the hurried pole buyer.

POLES

MOLONEY
TRANSFORMERS



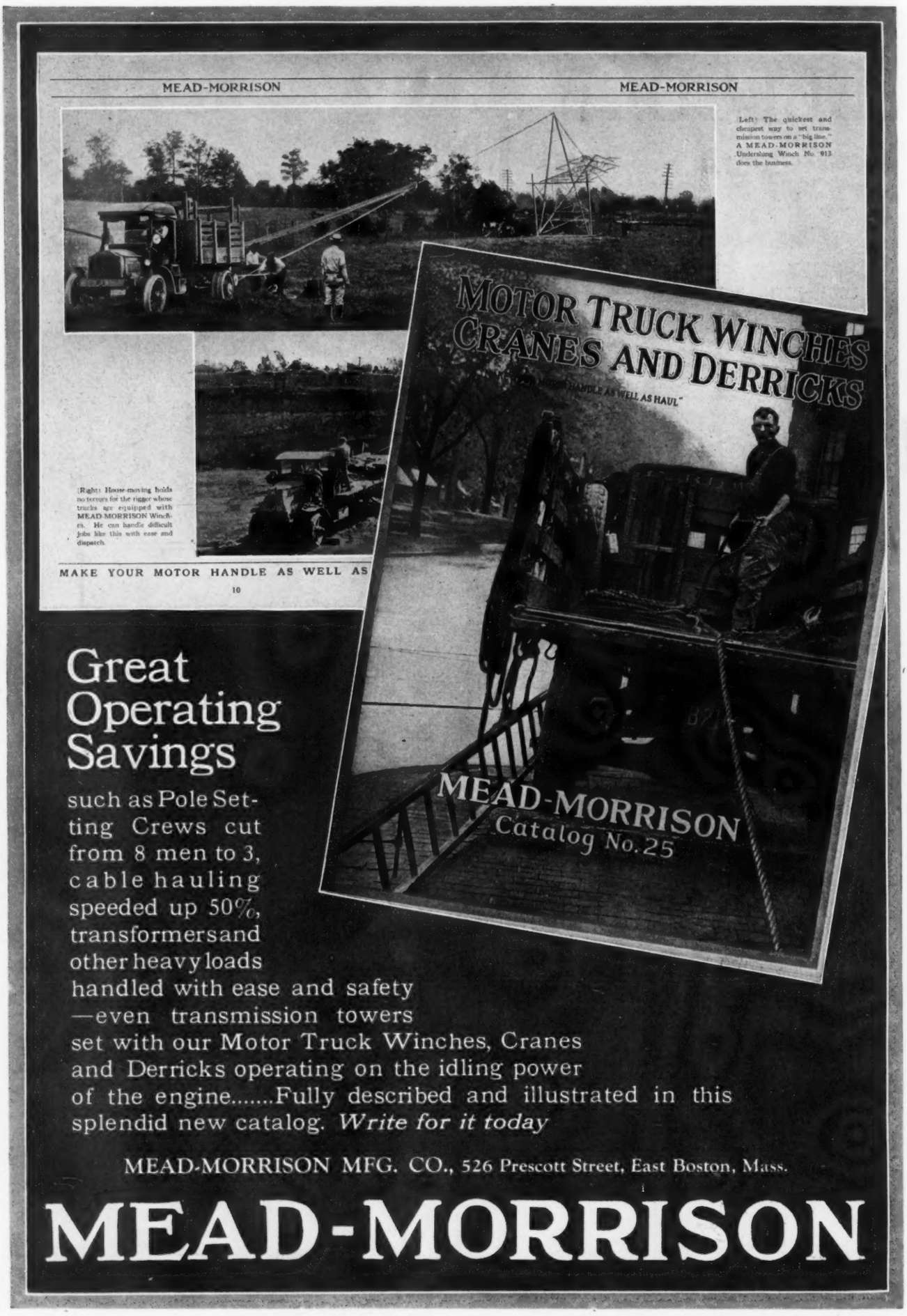
RELIABLE IN SERVICE

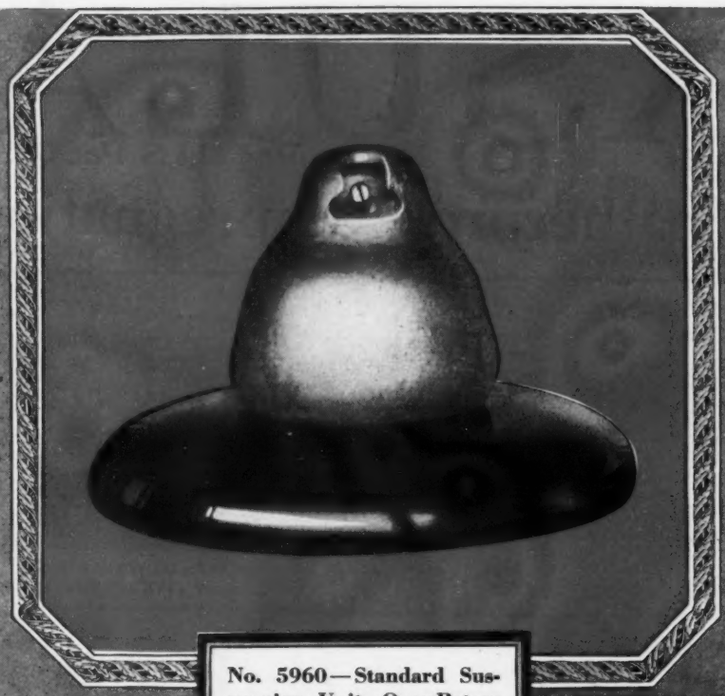


Another Moloney Installation

Carefully selected materials
—plus a full knowledge of transformer requirements.
—based on many years' experience in building transformers for the electrical field.
—has produced confidence in Moloney quality.
—typified in the ever-increasing demand for Moloney Transformer.
—proven by the need for our recently enlarged factory and production facilities.

MOLONEY ELECTRIC CO.
Main Offices and Factories
ST. LOUIS, MO.


MEAD-MORRISON
MEAD-MORRISON
(Left) The quickest and cheapest way to set transmission towers on a "big line." A MEAD-MORRISON Underslung Winch No. 913 does the business.
(Right) House-moving holds no terrors for the rigger whose trucks are equipped with MEAD-MORRISON Winches. He can handle difficult jobs like this with ease and dispatch.
MAKE YOUR MOTOR HANDLE AS WELL AS
10
MOTOR TRUCK WINCHES CRANES AND DERRICKS
MEAD-MORRISON
Catalog No. 25
Great Operating Savings
such as Pole Setting Crews cut from 8 men to 3, cable hauling speeded up 50%, transformers and other heavy loads handled with ease and safety —even transmission towers set with our Motor Truck Winches, Cranes and Derricks operating on the idling power of the engine.....Fully described and illustrated in this splendid new catalog. Write for it today
MEAD-MORRISON MFG. CO., 526 Prescott Street, East Boston, Mass.
MEAD-MORRISON



No. 5960—Standard Suspension Unit. Over-Potential Tested.

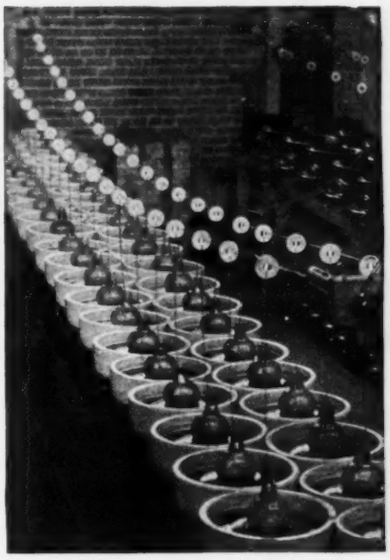
High Insulator Costs Again or the Over-Potential Test?

TO make an insulator with unequalled service-life and dielectric strength is not enough. The hard task is to convince buyers that have not used Lapp porcelain that the feat has really been accomplished.

Porcelain ills come usually from inadequate preparation or "aging" of the clay. The secret of aging has been discovered—and patented. It consists of removing dissolved and occluded air by the vacuum process, thus making the clay homogeneous—free from microscopic air bubbles, laminations, etc. This is an exclusive Lapp feature.

Lapp Insulators undergo an Over-Potential Test, 25% above standard practise. Factory rejects are surprisingly few, proving that Lapp Insulators are stronger than even the Over-Potential Test indicates.

Perhaps that's why only Lapp Insulators carry an under-glaze date of manufacture. Lapp wants you to know approximate date of original installation to prove by your own experience that Lapp Insulators save service costs and re-installing.



View of Lapp Over-Potential Test. The potentional loading is constant and severe. Insulators of questionable quality cannot survive.

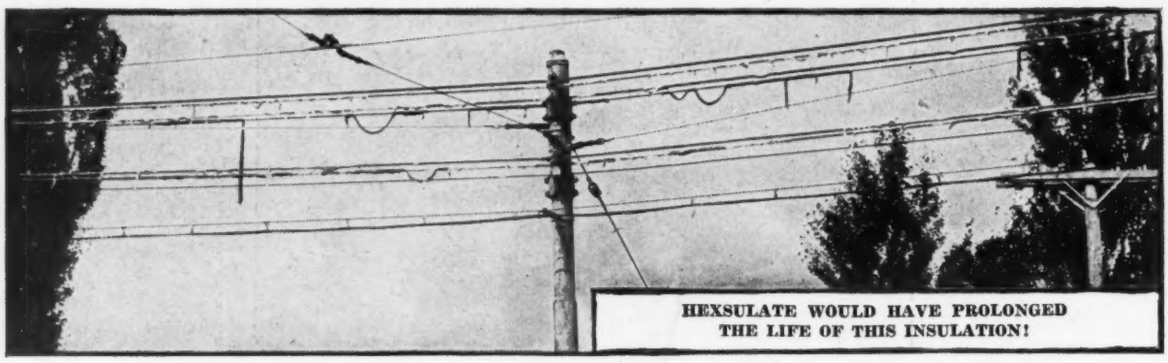
Lapp Insulator Co., Inc.

Le Roy, New York, U. S. A.

HEXSULATE

Trade Mark Reg. U S Pat. Off

Weatherproof Impregnation



"1. Long Life—Weather Resisting"

HEXSULATE CHARACTERISTICS

1. Long life—weather resisting.
2. Sufficiently liquid for perfect impregnation at 250 F.—braid uninjured at this temperature.
3. High Dielectric strength — insuring good insulation.
4. Unusual ductility — meets bending requirements.
5. Not tacky or sticky — meets drip and melt test requirements — clean to handle.
6. Fungus and microbe resisting.

The length of life of weatherproof wire insulation depends on, 1—The kind of cellular covering used, whether cotton or jute yarn or cotton roving; 2—The kind of material with which it is impregnated; 3—And the manner in which these two are applied.

Of these the impregnating material is the most important. It provides both the insulating properties and protection from the weather, while the fibrous covering merely acts as a binder or base to carry it.

HEXSULATE is the ideal Impregnating Compound. It was developed for this specific purpose by our Research Department, which has had years of experience with roofings that show service of 50 to 60 years and with high grade wood preserving creosoting oils that are used in the treatment of railroad ties, telegraph and power transmission poles, cross-arms, etc. This combination of "Long Life" and "Weather Resistance" gave our engineers and chemists a wealth of experience to draw upon in developing this insulating and weatherproofing product—HEXSULATE.

HEXSULATE is sufficiently liquid at impregnating temperatures to allow complete saturation in every fibre of the cotton or jute covering. It has sufficient stability and body so that, when exposed to the direct rays of the sun, it does not become fluid enough to travel or leach from the top of the wire to the bottom, thus exposing the unprotected covering to the elements. There is no "top and bottom" to wire made with HEXSULATE.

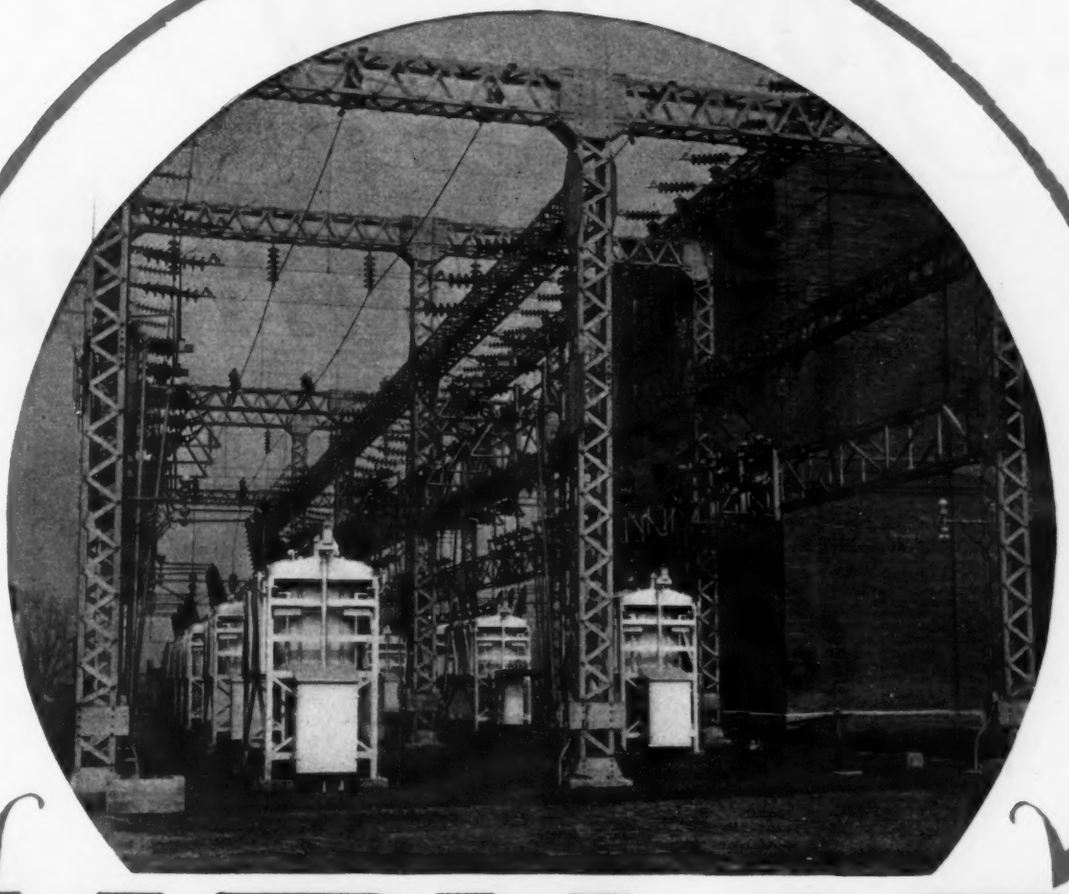
Insure long life insulation by specifying HEXSULATE Impregnation on your weatherproof wire.

TAR PRODUCTS CORPORATION

Providence, Rhode Island

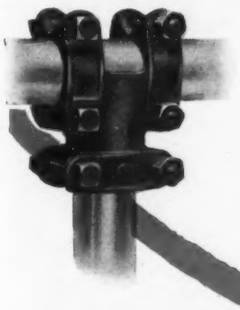
New England Division of
AMERICAN TAR PRODUCTS COMPANY
Pittsburgh, Pennsylvania

[EACH CHARACTERISTIC WILL BE DISCUSSED IN A SEPARATE ADVERTISEMENT]

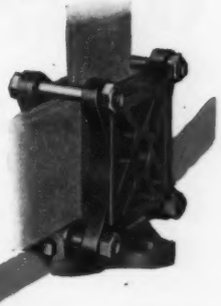


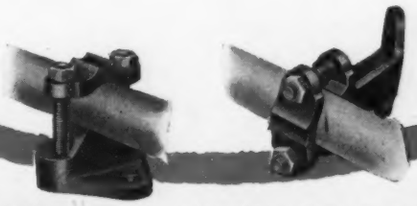
MEMCO

SUBSTATION EQUIPMENT



Is designed and built for service, above all else. It is priced in accordance with the service-ability it affords. Its first cost is what such superquality demands. It is a first cost which assures uninterrupted service, low maintenance, minimum after-costs.





MEMCO ENGINEERING & MANUFACTURING CO., INC.
381 Hamilton Street Long Island City, N. Y.

.....for easy carrying

ORANGEBURG FIBRE CONDUIT

THE convenient five foot lengths and the lightness of Orangeburg Fibre Conduit have contributed to its many years of popularity. The experience of many users all over the world has shown for 35 years that Orangeburg Fibre Conduit provides the most practicable cableways for every variety of underground electric cables.

This long history of successful use and constant reorders is proof that Orangeburg Conduit stands the test of time.

The smooth-fitting joints, and accurate interior surface of Orangeburg Fibre Conduit, insures cableways which are uniformly smooth and circular.

This feature insures against damage to cables while being drawn through Orangeburg Fibre Conduit.

For full information, write Johns-Manville Corporation, 292 Madison Ave., New York City, New York.

The Fibre Conduit Co.
ORANGEBURG, NEW YORK

Johns-Manville
CORPORATION
SOLE SELLING AGENTS

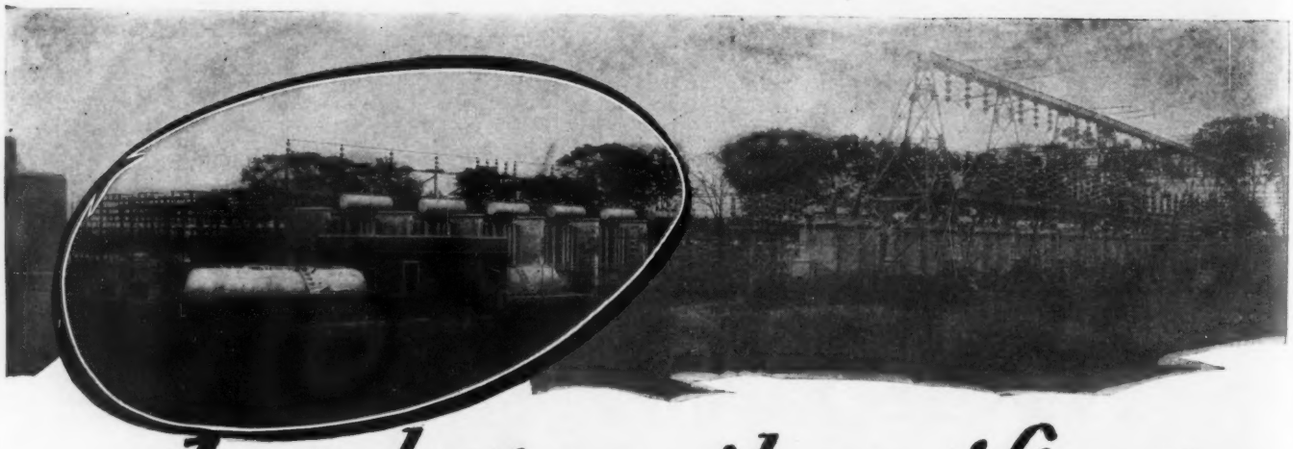
LOW INITIAL COST

THE low initial cost of open type Matthews Fuswitches and their dependability makes them preferred for protection of rural transformers, branch lines and substations. Features of Matthews Fuswitches include easy re-fusing, high rupturing capacity, certainty of operation and good insulative qualities.

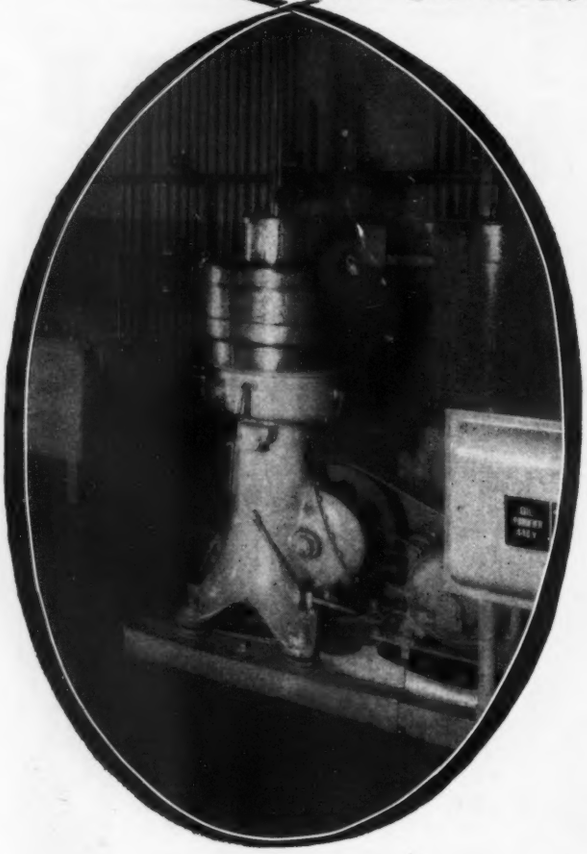
Bulletin 502 contains full descriptions of types, ratings and features of Matthews Fuswitches and Disconnecting Switches. Your electrical wholesaler can supply you with Matthews Specialties.

W.N.MATTHEWS CORPORATION
Engineers and Manufacturers
3702 Forest Park Boulevard
St. Louis, U. S. A.
Offices in All Principal Cities

MATTHEWS FUSWITCHES
and DISCONNECTING SWITCHES
168 *INTERCHANGEABLE*



Insulating oil purification —a construction problem



Completion of the oil purification plant ahead of the rest of the sub- or switching-station is a new short cut to economy in getting transformers and circuit breakers into operation.

Pipe connecting the transformers and breakers to a central oil purification plant equipped with large capacity De Laval Insulating Oil Purifiers has proved to be by far the most economical means of maintaining the di-electric strength of oil at the large stations which are now being built by many systems.

Such a purification plant performs its greatest service, and may often entirely pay for itself, during the period in which the substation is under construction and oil holding apparatus is being filled. For this reason, it is becoming standard practice to build and equip the oil purification plant before the transformers and circuit breakers are erected, so that oil can be readily unloaded from the cars, dehydrated and pumped into the units.

De Laval engineers will be glad to co-operate with you in designing, constructing and operating your substation oil purification plants. Write for Bulletin 107-W.

THE DE LAVAL SEPARATOR COMPANY
165 Broadway, New York 600 Jackson Blvd., Chicago
DE LAVAL PACIFIC COMPANY, 61 Beale Street, San Francisco
THE DE LAVAL COMPANY, Ltd., Peterborough and Winnipeg, Canada.
ALFA-LAVAL CO., Ltd., 34 Grosvenor Road, London, S. W. 1.

DE LAVAL OIL PURIFIERS

Types for Lubricating Oil and Insulating Oil

Why Western Red Cedar is preferred

Simply because Western Red Cedar has the natural qualities for pole service it has gained wide recognition and is being used more extensively today than ever before. Even for wooden tower construction, Western Red Cedar has proven its practicability and economy.

Wherever Western Red Cedar has been used results have been most satisfactory.

B. J. CARNEY & CO.

PENTREX

guarantees ⅝ or ½ inch penetration on every pole.

Main Offices

100 North 7th St. Minneapolis — Sicamous, B. C. Enderby, B. C. — Peyton Bldg., Spokane, Wash.

Treating Plants

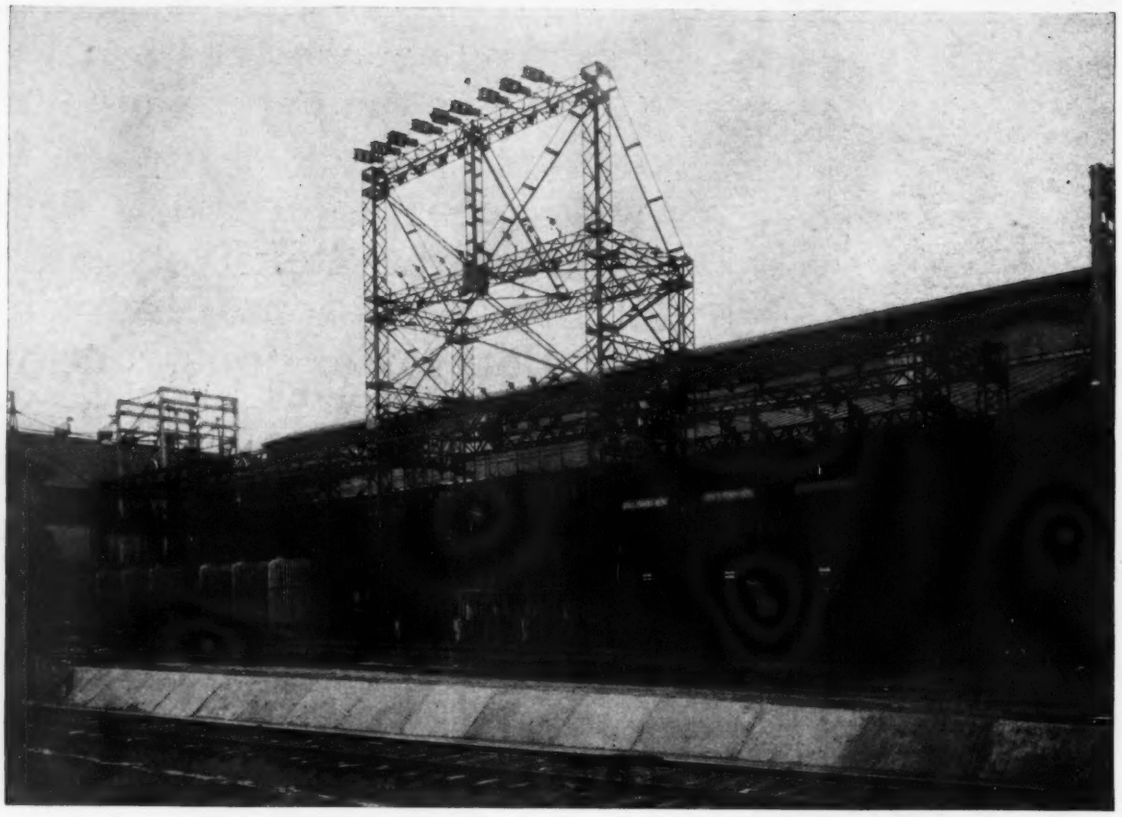
Minneapolis — Sand Point — Spokane

General Sales Offices

237 Commercial Tr. Bldg., Philadelphia — 115 So. Dearborn St., Chicago — 214 Old South Bldg., Boston

701 Midland Bldg., Kansas City, Mo. — 905 2nd Nat'l Bank Bldg., Cincinnati, Ohio — 839 Oliver Bldg., Pittsburgh

"GPM" SWITCHES



33 K.V. 18,000 K.V.A. Substation With "GPM" Gang Operated Disconnects.

Several years' operating experience proves that the "GPM" switch has and continues to meet the requirements of service and its simplicity of design is an important factor in this successful record.

An outstanding feature is the fact that but two insulators per pole are necessary, a total of six for a three-pole switch, thus reducing both the initial and maintenance costs.

The double self-aligning contacts not only insure good contact but when the switch is in open position these contacts close up completely, thus excluding ice, dirt, and other foreign material, and limiting corrosion.

FACTS ABOUT THE "GPM" SWITCH

The "GPM" base mounts vertically and the blades have a side opening movement which eliminates the usual assortment of cranks and other parts required to transfer a rotating insulator movement into a vertical movement of the blade.

The lower insulator is pivoted on a substantial bearing turning as the switch opens and the center line of the conductor lug is in line with the insulator bearing so that this lug and its connection to the oil switch remains stationary.

The "GPM" operates very easily. A spring in the operating mechanism is compressed when the switch is in open position and assists when closing, the arrangement being such that a well-balanced movement insures easy operation.

Two insulators per pole mean lower maintenance and lower cost. The side break makes it possible to use a minimum number of parts and do away with troublesome adjustments. Double self-aligning and self-closing contacts prevent entrance of dirt when the switch is in open position. The very nature of the switch is such as to make it easy to open and close.

MAKERS OF Delta UNIT TYPE EQUIPMENT Star

DELTA-STAR ELECTRIC COMPANY, 2400 BLOCK, FULTON ST, CHICAGO, ILLINOIS.

HOLDING POWER!!

The Essential Factor When Anchors Are Being Specified

DEPENDABLE anchorage year after year is essential. That is why holding power is the factor which brings the ultimate decision for anchor selection. In Kearney Hi-Tension 4-in-1 Expansion Anchors, you will find the answer — they have a greater holding power than any other anchor of equal inches of surface. Tests on any of the five sizes of these anchors will back up this statement —they are all made of certified malleable iron, guaranteed against breakage.

OTHER KEARNEY UTILITY SPECIALTIES

GUY WIRE CLIP

SOLDERLESS SERVICE CONNECTOR

STEEL ROD SCREW ANCHOR

PIPE ROD SCREW ANCHOR.

FOR light and power utilities, Kearney Engineers have designed solderless service connectors, guy wire clips, steel rod and pipe rod screw anchors, double duty fuse and disconnect cutouts, fuse, disconnect, and choke-fuse combination switches, handy fuse pullers, bullet type plug cutouts, sleeve twisters with interchangeable dies, hot tap clamps, economy cable clamps, yokes, splice balls, clevises, and underground cable boxes.

Holding Power of Kearney Hi-Tension 4-in-1 Expansion Anchors

Cat. No.	Sand	Clay	Hard Pan
5053	3,000	5,000	7,000
6076	4,000	8,000	12,000
7104	6,000	11,000	16,000
8126	10,000	16,000	22,000
10208	16,000	24,000	32,000

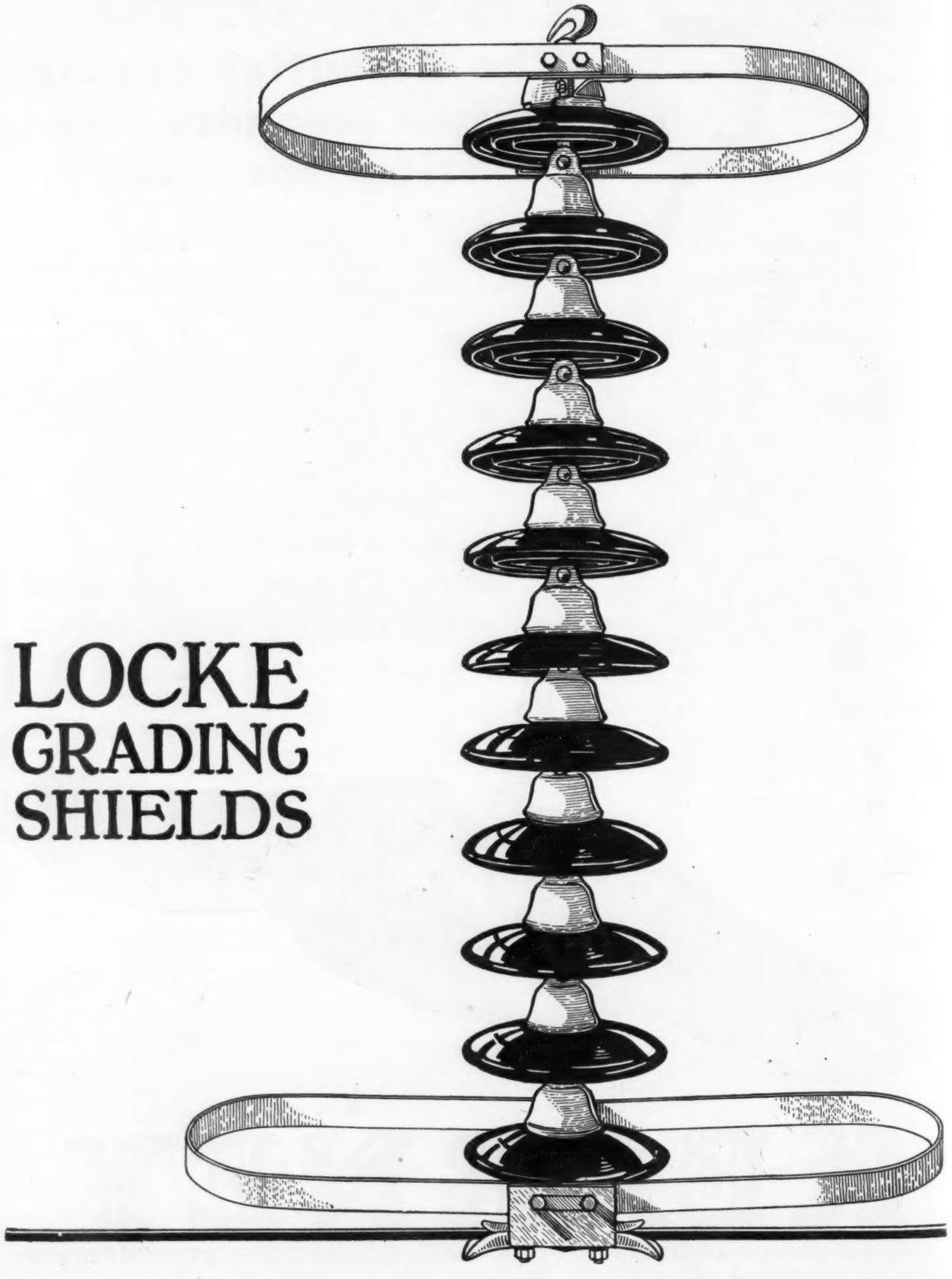
OTHER features of Kearney Hi-Tension 4-in-1 Expansion Anchors include: Ease of installation, capable of being installed in any kind of soil, at any angle, to any depth, and in any location.

Bulletin No. 301 covering Kearney Hi-Tension 4-in-1 Expansion Anchor will be sent on request.

JAMES R. KEARNEY CORPORATION
4224 CLAYTON AVENUE ST. LOUIS, MO.

KEARNEY

OVERHEAD AND UNDERGROUND UTILITY EQUIPMENT



LOCKE GRADING SHIELDS

When service counts

Five years ago the first Locke Grading Shields were installed. Today, all over the country, on many of the most important transmission systems, thousands of Locke Grading Shields are helping maintain the continuous service for which all engineers are striving. The promises made by early experiments in the laboratory have been amply fulfilled in actual field service.

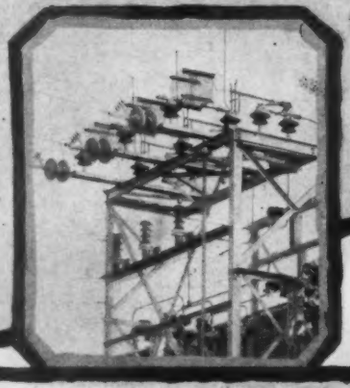
On suspension lines from 66 kv up they will decrease flashovers and minimize the damage done by the flashovers that do occur. It is no coincidence that Locke Grading Shields are in use on every 220 kv system in the country.

LOCKE INSULATOR CORPORATION
BALTIMORE MARYLAND

specify

LOCKE PORCELAIN INSULATORS

DEAD ENDS



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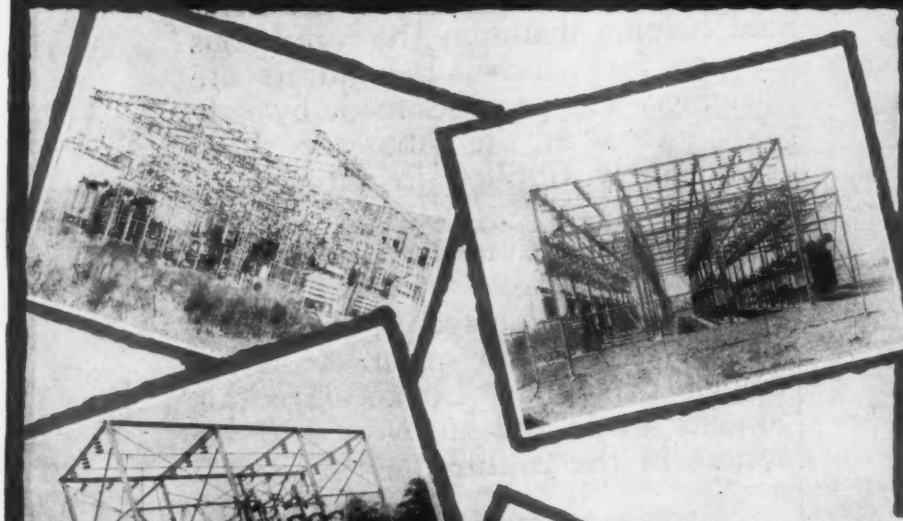
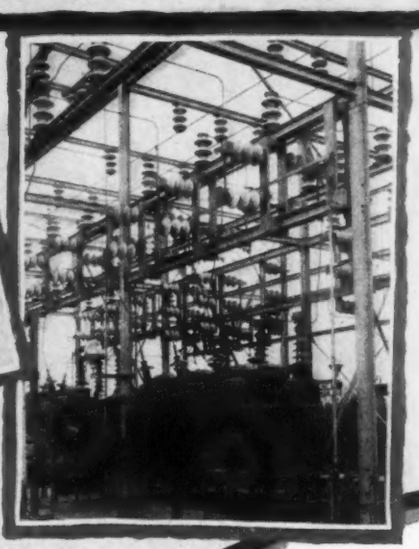
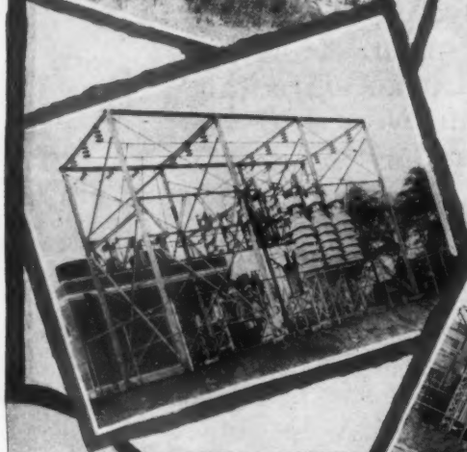
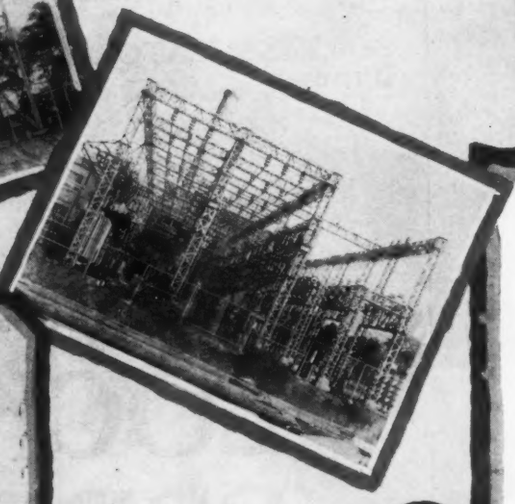
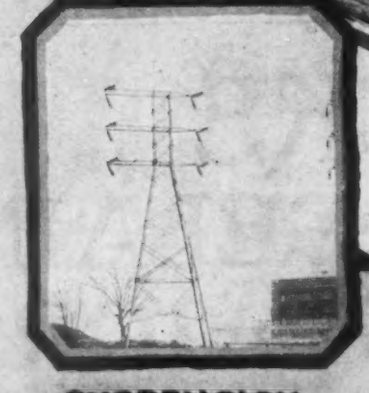
SPECIFIED on the basis











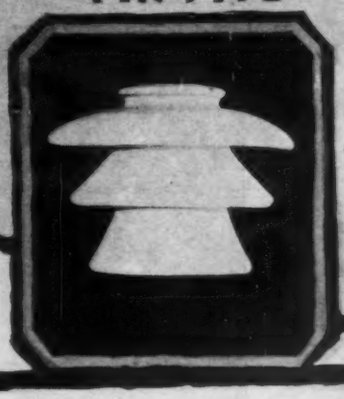
SUSPENSION

Here are some illustrations typical of a large number of new jobs on which J-D insulators have been specified by engineers in different parts of the United States:

The basis of insulator purchases is confidence that the maker will deliver a sound product. Jeffery-Dewitt is prepared to do so, by: (1) ideal fuel supply, (2) finest mechanical equipment, (3) exclusive proc-

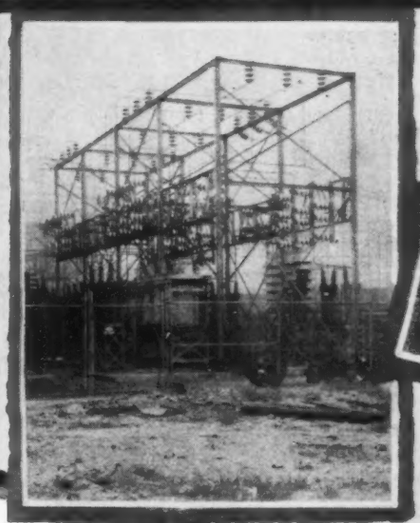
JEFFERY-DEWITT
Kenova, W. Va.,

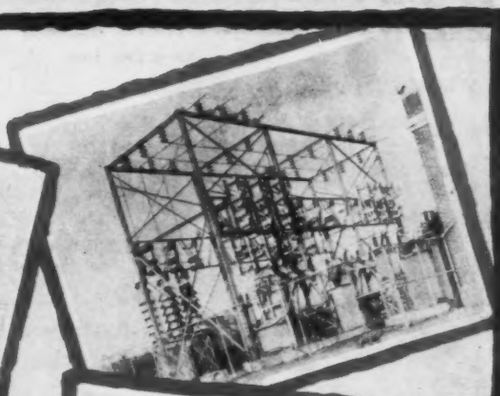
PIN TYPE

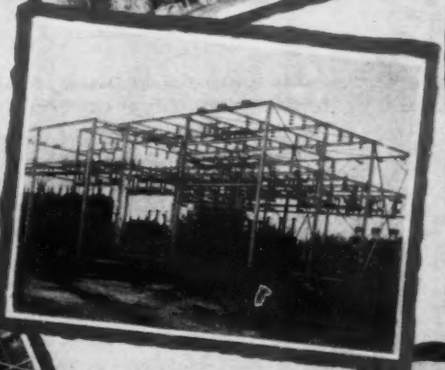


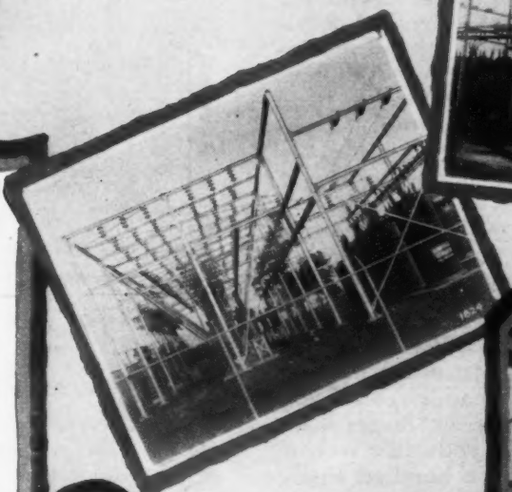
J-D

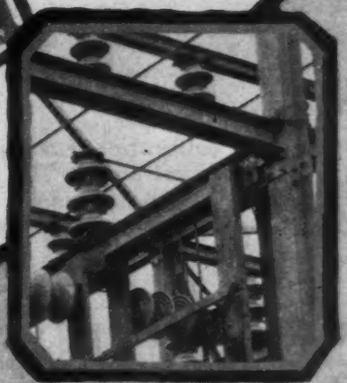
of past performance







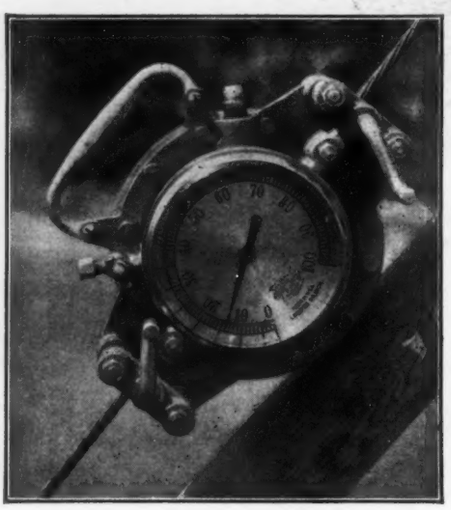




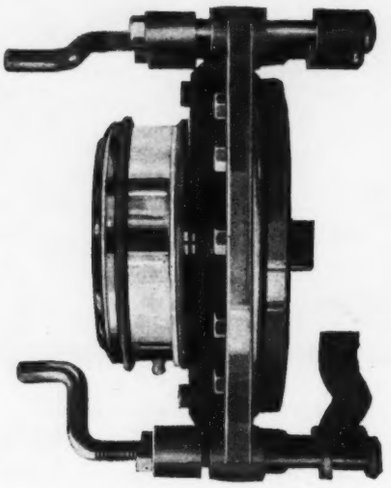
POST TYPE

esses controlled and perfected through years of effort and experience, and (4) the will to excel. Each J-D insulator is built to build customer confidence. The earned confidence of power companies is our most valued asset. Send for catalogs of standard products; submit your problems to our engineers when special shapes of high grade porcelain seem necessary.

INSULATOR CO.
U. S. A.



The Tension Indicator
on a guy line.



Just open the clips, insert wire
and tighten.

Why Dead-End » »
To Determine Tension?

The Martin-Loomis Tension Indicator accurately measures the tension without the necessity of dead-ending or cutting wires.

Heretofore, in order to determine the tension on guys or conductors, it has been necessary to cut or dead-end the wire. Now with the Martin-Loomis Tension Indicator simply clamp the instrument to the wire either BEFORE, DURING or AFTER tension has been applied. It will accurately indicate tension to a maximum of 16,500 lb. on any wire or cable up to a diameter of one inch. Only one instrument is needed on a job as it may be moved in a few moments without disturbing the set-up.

This instrument operates on an hydraulic pressure principle, the tension on the wire exerting pressure on a diaphragm supported by water. Readings may be either in pressure, readily converted with calibration curves, or direct with special dial faces. The indicator weighs only 11½ lb. and may be handled easily even in awkward positions.

Calibration curves for various types and sizes of wire and cable are available.

The Tension Indicator may be used to:

"Sag-in" transmission and distribution lines.

Determine guy line strains on anchors.

Determine types of tower footings best suited to various soils.

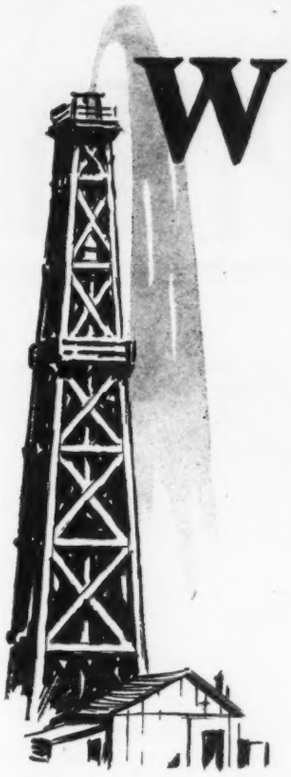
Adjust load proportionately on two or more guys on the same pole.

These are only a few of its many uses.

Write for literature and further information.

MARTIN-LOOMIS CORPORATION

2827 Cherry Avenue **Long Beach, California**



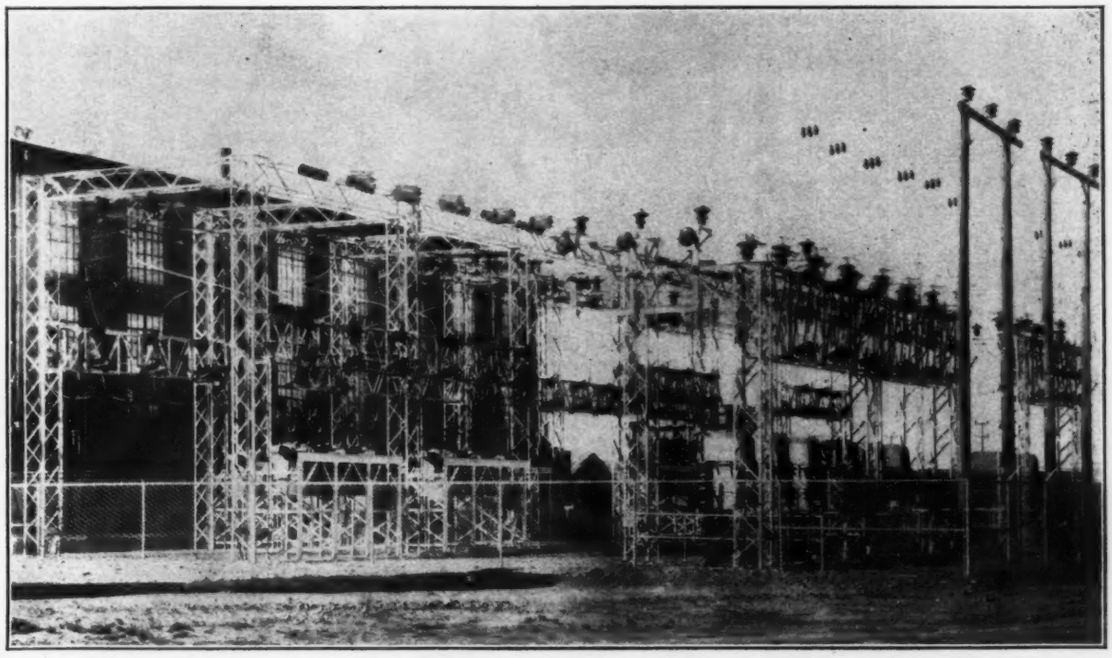
WHEN DELAY MEANT WASTE!

The Petroleum Industry Cannot Wait— Power Must Be Delivered When Needed.

The Pecos Valley Power and Light Company had important oil pumping load contracts that called for electric power on July 15, 1927. The order for the steel switching structure, oil circuit breakers, air break switches and bus fittings was awarded to the Pacific Electric Manufacturing Co., on April 26, 1927. Complete shipment was made in less than 40 days and the completed plant and power lines went into service on July 15, 1927.

Pacific Electric Service made possible this fast delivery of the following major items:

35,000 lbs. Galvanized Steel Structure
4—73 KV. Oil Circuit Breakers
17—73 KV. Air Break Switches
Choke Coils
Fuse Supports
Bus Supports, Connectors and Fittings



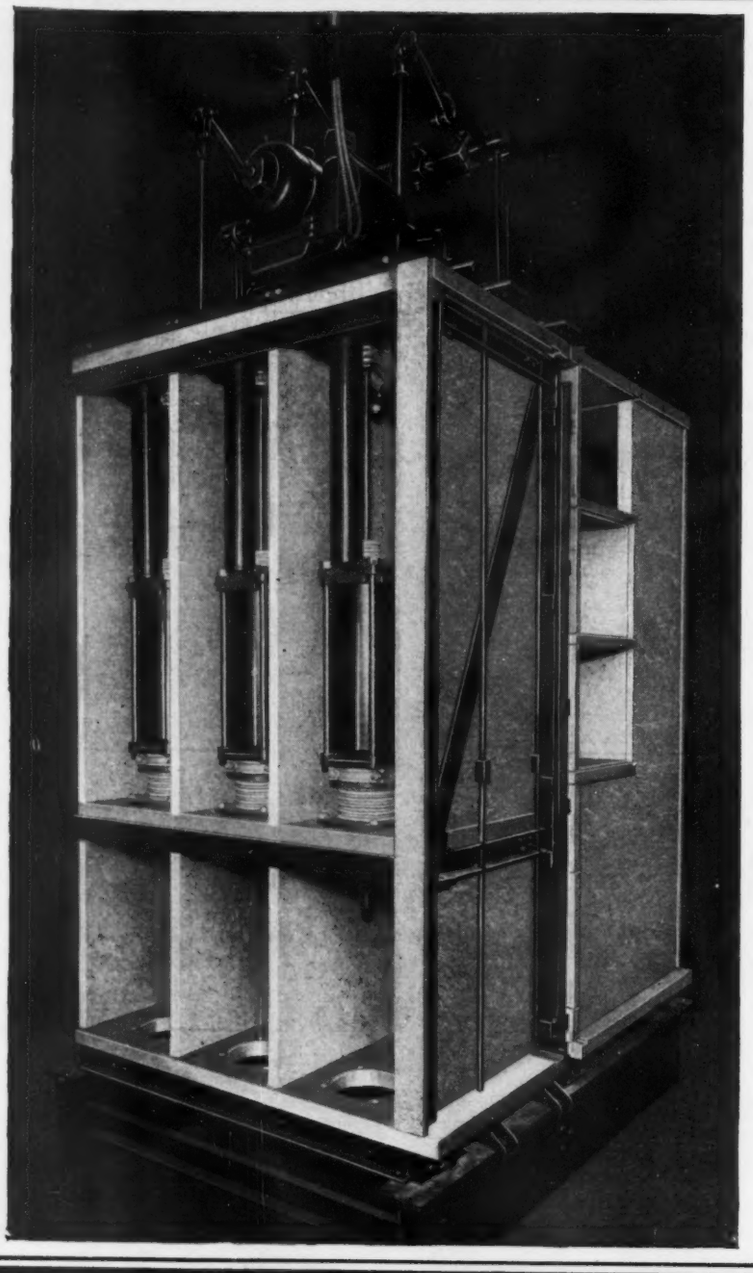
McCamey, Texas, Steam Electric Generating Plant of the Pecos Valley Power and Light Co.
Ford, Bacon & Davis, Inc., Engineers in Charge of Design and Construction

Pacific Electric Manufacturing Corp.

5815 THIRD STREET, SAN FRANCISCO, CALIF.

Representatives in Principal Cities

SIMPLIFY



Standardization of equipment simplifies both your design and construction problems. But be sure your plans are built around the right standards.

FABRICATED SWITCH CELLS OF ALBERENE STONE will enable you to extend your switch and bus structure as needed, by the addition of units standardized according to your own specifications.

These cells are self-contained unit structures of *Alberene Stone* slabs and standard steel shapes—fabricated by us to conform with your switch and bus arrangement—delivered "knocked down" —and easily and quickly assembled either by us or by your own labor force.

You save time, labor, and "messing up" your station. You have standardized construction, with safety and permanance assured by the time-tested mechanical and electrical qualities of *Alberene Stone*. Extensions mean simply the addition of standard units as needed.

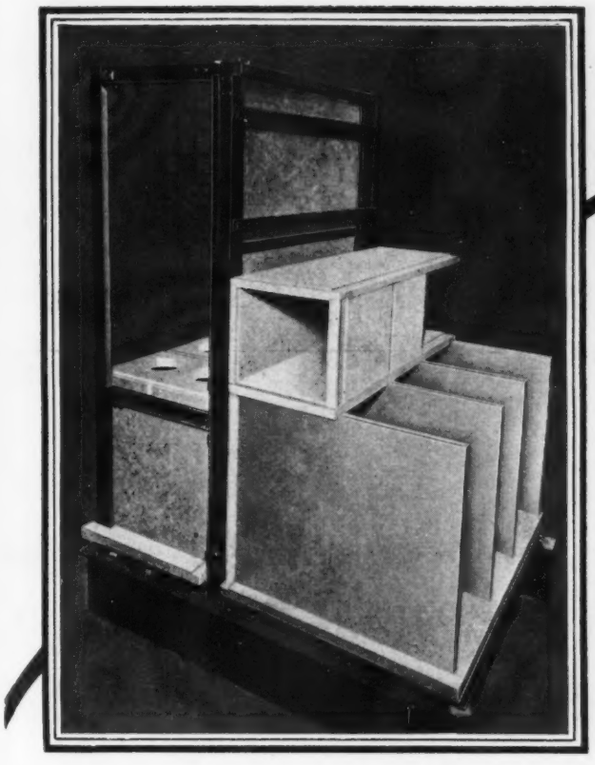
Let us tell you more about this new type of construction employing Alberene Stone, *an electrical standard for over 35 years.*

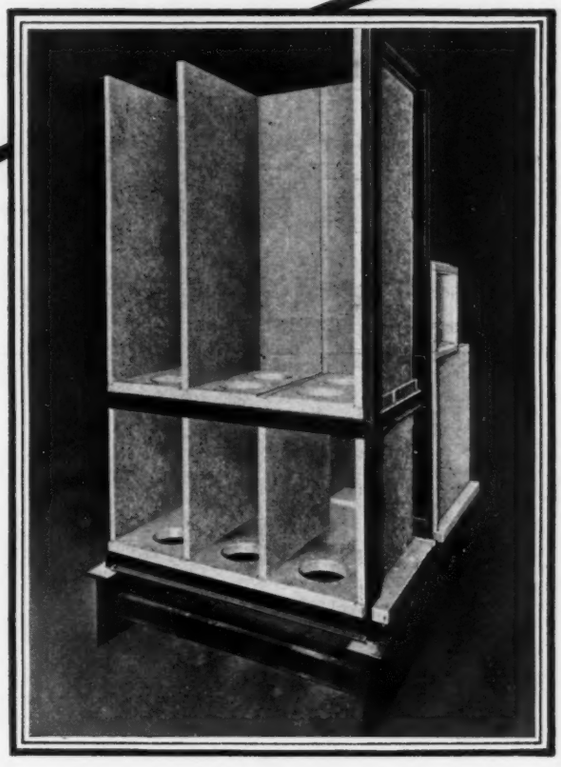
Alberene Stone Co.
153 W. 23rd St., New York City, U.S.A.
Offices in principal cities

ALBERENE TRADE BEST MARK STONE

READY-CUT SWITCH CELLS of

YOUR STATION PLANNING





THE picture on the left-hand page shows an assembled *Alberene Stone Switch Cell*—one complete, self-contained unit, with oil switch compartments in front and bus compartments in the rear. Illustrated above is the same unit in process of assembly, showing the tongue-and-groove construction (possible only with *Alberene Stone*) whereby solidity, continuity and perfect alignment are assured.

Recent purchasers of *Alberene Stone Fabricated Switch Cells* are:—International Paper Co., Kents Falls Development, 9 oil switch cells; International Paper Co., Grand Falls Development, 125-ft. bus structure with oil circuit breaker and disconnect switch compartments; National Tube Co., Elwood City Works, 9 units comprising circuit breaker and disconnect switch compartments, bus structure and flooring; Northern Westchester Lighting Co., compartments for circuit breakers, disconnect switches, regulators and reactors and bus structure; General Electric Co., West Lynn Works, 28 G. E. Type F. H. oil switch cells, with disconnect switch compartments and bus structure.

ALBERENE STONE

A NATURAL STONE OF DIVERSIFIED ELECTRICAL UTILITY

A. C. S. R.

A. C. S. R. is used on every 220,000 volt transmission line in the United States and Canada. It is human nature to emphasize such advanced installations—and it is prime evidence of dependability that A. C. S. R. has been chosen for such service.

However, A. C. S. R. is not exclusively a high-voltage conductor—it is well suited to every-day low voltage, short-span lines. Our sales records say so. Over two-thirds of the more than 280,000 installed miles of A. C. S. R. made by us, are in the small sizes used for low-voltage lines, such as rural distribution. In such lines, not only dependability, but ease in stringing and the convenience of fittings, are matters of importance.

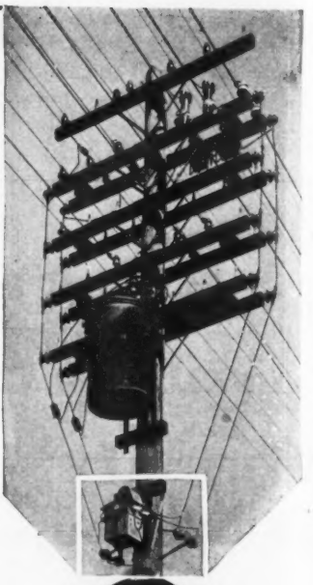
A. C. S. R. has its part, therefore, in carrying power to the farmer. The power industry is working toward selling the farmer more and cheaper power. The interest is selfish, of course, but the buyer will profit as well as the seller —the farmer as well as the power company. Cheap electric power can do for the American farmer what it has done for American industry.

It does hard work quickly and easily—it allows cheap cold storage—it produces controlled heat—it will invite diversification of crops—it will bring profits and prosperity. More power to the farm—with A. C. S. R. as the conductor!

ALUMINUM COMPANY *of* AMERICA
2400 OLIVER BUILDING · PITTSBURGH, PENNA.

A. C. S. R. for CONDUCTORS and GROUND WIRES ALUMINUM BUSBARS..

Six reasons for SAUTER *Electric Time Switches* for Series Street Lighting

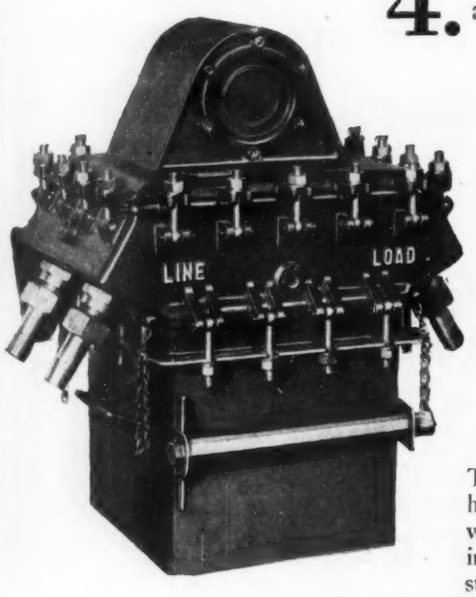


1. LOW INVESTMENT. 'Sauterizing' eliminates separate feeders; does away with pilot wires; saves valuable station space.

2. LOCALIZED CONTROL. Each Sauter-controlled circuit is self-contained . . . complete to function by itself. NOT a link in a chain and NOT depending on outside control impulses.

3. POSITIVE SWITCHING. In reality each Sauter primary voltage time switch is a motor-operated oil circuit breaker; quick-acting, self-locking in both "on" and "off" position, long lived.

4. SOLAR-TIME SWITCHING. Day by day the astronomic dial automatically follows the change in your schedule, based on local time of sunset and sunrise. (This dial is equally well suited for half-night lighting.)



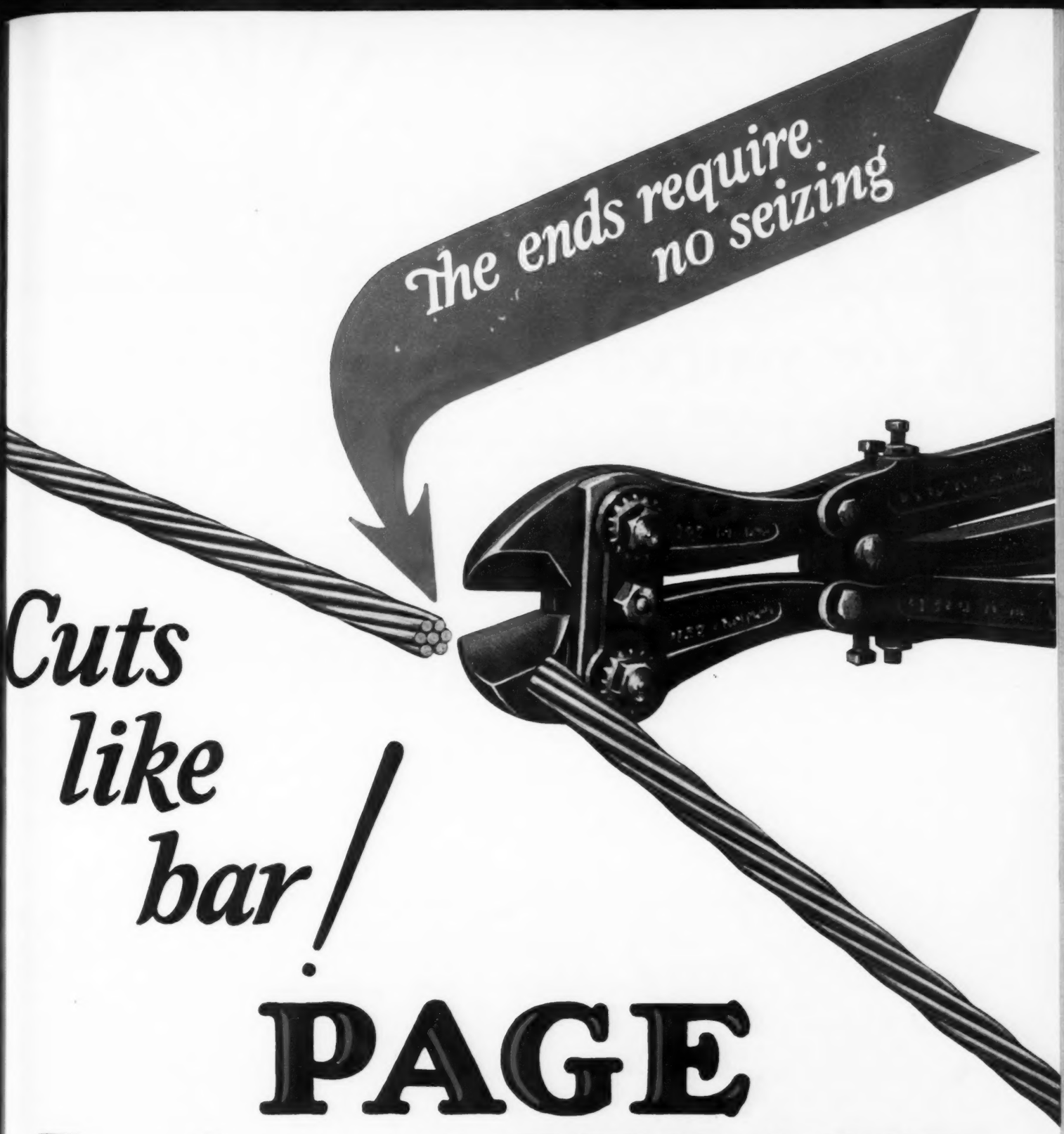
This submersible switch has 4 disconnect-type wiping sleeves. A small in-built transformer supplies proper voltage for operation.

5. MAXIMUM CERTAINTY. 'Sauterizing' is excellent protection against the vexations of "lights out at night" and "lights burning in the daytime."

6. LOWEST MAINTENANCE. Being fully automatic in every respect Sauter astronomic time switches require little supervision. Sound design and quality insure long and faithful service at minimum maintenance cost.

R. W. Cramer & Co., Inc.

136 Liberty Street, New York, N. Y.

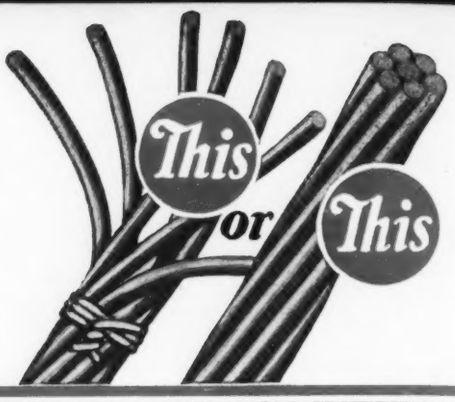


Cuts like bar!

PAGE *Preformed* STRAND

Page Preformed Strand is made by a new process — the first basic improvement in strand wire manufacture in 100 years. Turn the page and read the 7 seven outstanding advantages.

Prove



for yourself
PAGE *Preformed* STRAND'S

7 advantages

1. *on seizing—none needed*
2. *cuts like solid wire*
3. *no waste from unstranding*
4. *uniform lay—easier to splice*
5. *tighter construction, resists corrosion*
6. *equal distribution of load*
7. *Tru-loc fitting gives 100% strength at joints*

Think of a strand that can be cut and handled like rod—that requires no seizing—which, instead of flying apart into tangled wire can actually be taken apart at ends and *restranded*—a strand that is so uniform and smooth that it provides no place for the collection of dust and cinder to start corrosion.

You must hold a piece of Page Preformed Strand in your hand to appreciate the difference between it and ordinary strand—to gain a full realization of the time it can save your workmen—the *waste* it can prevent. The coupon will bring a sample. Mail it today.

ACCO
AN ASSOCIATE COMPANY OF AMERICAN CHAIN COMPANY, Inc.
in business for Your Safety

STEEL AND WIRE
PAGE
QUALITY PRODUCTS

PAGE STEEL AND WIRE COMPANY

District Offices: Chicago, New York, Pittsburgh, San Francisco

An Associate Company of the American Chain Company, Inc.
BRIDGEPORT, CONNECTICUT

Manufactured under license arrangements with the American Cable Company, Inc.

Page Steel and Wire Company
Bridgeport, Connecticut

Gentlemen:
Better strand that costs less interests me. Send your bulletin and a sample of PAGE PREFORMED STRAND.

Address .....

Name .....

PAGE *preformed* Strand

Engineers have written:

(excerpts from letters on file)

"We are very much pleased with our Deceleco installation."

"We believe 'Zellite' is a very good material for electric barrier construction."

"We are satisfied that any further construction will be by means of Deceleco materials."

"This was one job that was carried out promptly and efficiently and gave us no worry."

"We are enthusiastic about its use,—it has real merit and consequent value."

"We are installing fifteen Deceleco structures and are well pleased."

Many such letters from users will indicate to you that you can have

Are these companies judges of proper cell structures?

American Gas & Electric Co.
Associated Gas and Electric System
Carnegie Steel Co.
Cincinnati Street Railway
City of Detroit
City of Lansing
Consumers Power Co.
Eastern Massachusetts Street Railway Co.
General Electric Co.
Goodyear Tire & Rubber Co.
International Paper Co.
John A. Roebling's Sons Company
Los Angeles Gas & Electric Co.
Monongahela & West Penn Public Service Co.
Northern States Power Co., Minneapolis, Minn.
Paul A. Sorg Paper Co.
Pollak Steel Co.
San Diego Consolidated Gas & Elec. Co., San Diego, Cal.
Sanitary District of Chicago, Chicago, Ill.
Utilities Power & Light Corp., Chicago, Ill.
Westchester Lighting Company, New York
Wheeling Electric Co.
Youngstown Sheet & Tube Co.

These companies have made installations of Deceleco cell structures in preference to the old type of concrete or brick work.

Sufficient data on installation cost and efficiency is available so that in using Deceleco you are not experimenting.

better cell structures with

DECELECO

—and at lower cost

(more excerpts)

"The cost was considerably less than concrete would have been."

"Does away with complicated and expensive form work."

"Entire installation cost came well below our labor estimate."

"Provides easy and economical cell work."

"We were able to saw and drill it with comparative ease."

What Is ZELLITE?

Zellite, the material from which Deceleco structures are built, is supplied in factory made cell wall units of various standard dimensions.

Test data on weight, tensile and compression strength, modulus of rupture, dielectric strength, moisture absorption, heat resistance are available.

These tests were made at Electrical Testing Laboratories, New York.

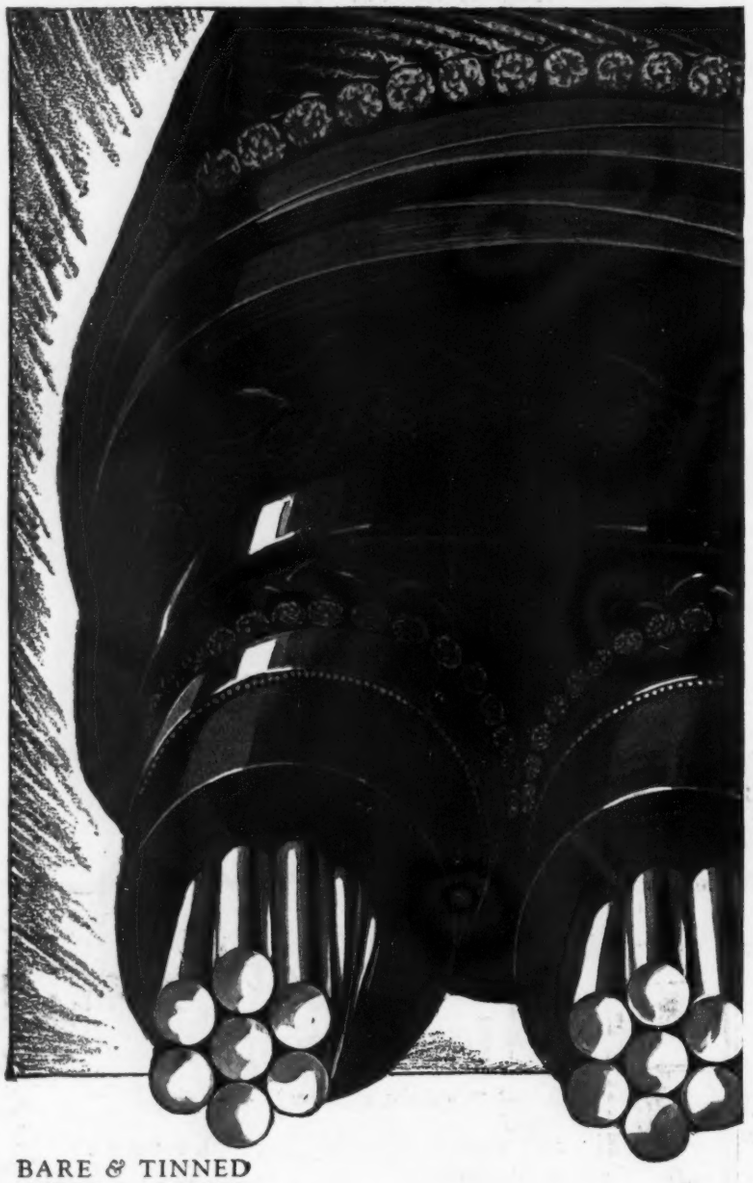
It can be cut, drilled and worked as easily as wood.

A book reproducing photos and detail drawings will be mailed upon request.

DECELECO, INCORPORATED

WAYNE, MICHIGAN

Not just another cable – but a new KIND of cable



Trenchlay is different from all other underground cables. Older forms were built by adding one or more protective sheaths to existing cable structures.

Trenchlay was not so improvised. It was designed from the conductors out to meet the exacting requirements of underground service.

Trenchlay construction is anhydrous throughout —homogeneous and non-wicking. It is unaffected by earth acids or alkalis. It will not corrode, rust or crystallize. Electrolysis, stray currents, and sheath loss troubles have been entirely eliminated.

We will be glad to send you full details about Trenchlay, samples to test, or a representative to explain its construction.

ROME WIRE COMPANY
DIVISION *of* GENERAL CABLE CORPORATION
Rome, N. Y.

BARE & TINNED WIRES · · · POWER CABLES · MAGNET, WEATHERPROOF & RUBBER COVERED WIRES · · FLEXIBLE WIRES, CABLES & CORDS · · SIGNAL & TELEPHONE WIRES · · · LEAD & STEEL-TAPED CABLES · SUPER SERVICE CORDS & CABLES · ROMEX · · · SPECIAL WIRES *to* SPECIFICATIONS

ROME WIRE

2825

FROM WIRE BAR TO FINISHED COPPER WIRE

SHARPLES PORTABLE PRODUCES *SAFE* TRANSFORMER OIL for the Potomac Edison Co.

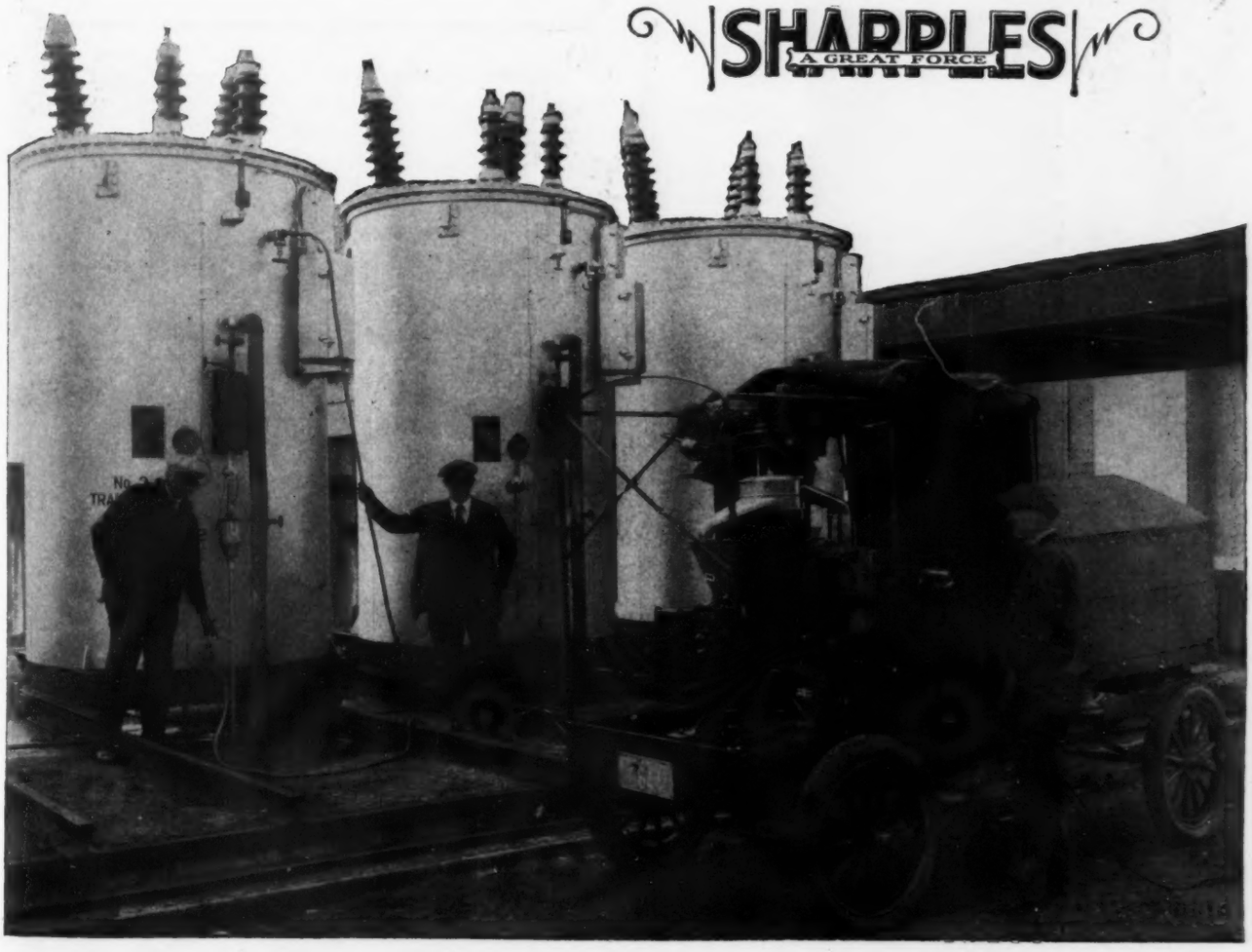
This great company is one of a long list of public utility corporations who find the Sharples a valuable asset in cutting transformer maintenance cost.

It is the most practical and effective apparatus for the quick dehydration of transformer oils. Mounted on an easily handled portable steel platform — complete with intake and outlet pumps and heaters—the Sharples Portable is always ready for service anywhere, by simply making electrical and oil line connections.

Complete Bulletins on purification of Transformer and Switch Oils will be mailed without obligation by Sharples Engineers.

THE SHARPLES SPECIALTY COMPANY
2314 Westmoreland Street Philadelphia, Penna.

SHARPLES
A GREAT FORCE



AMERICAN TRANSFORMER

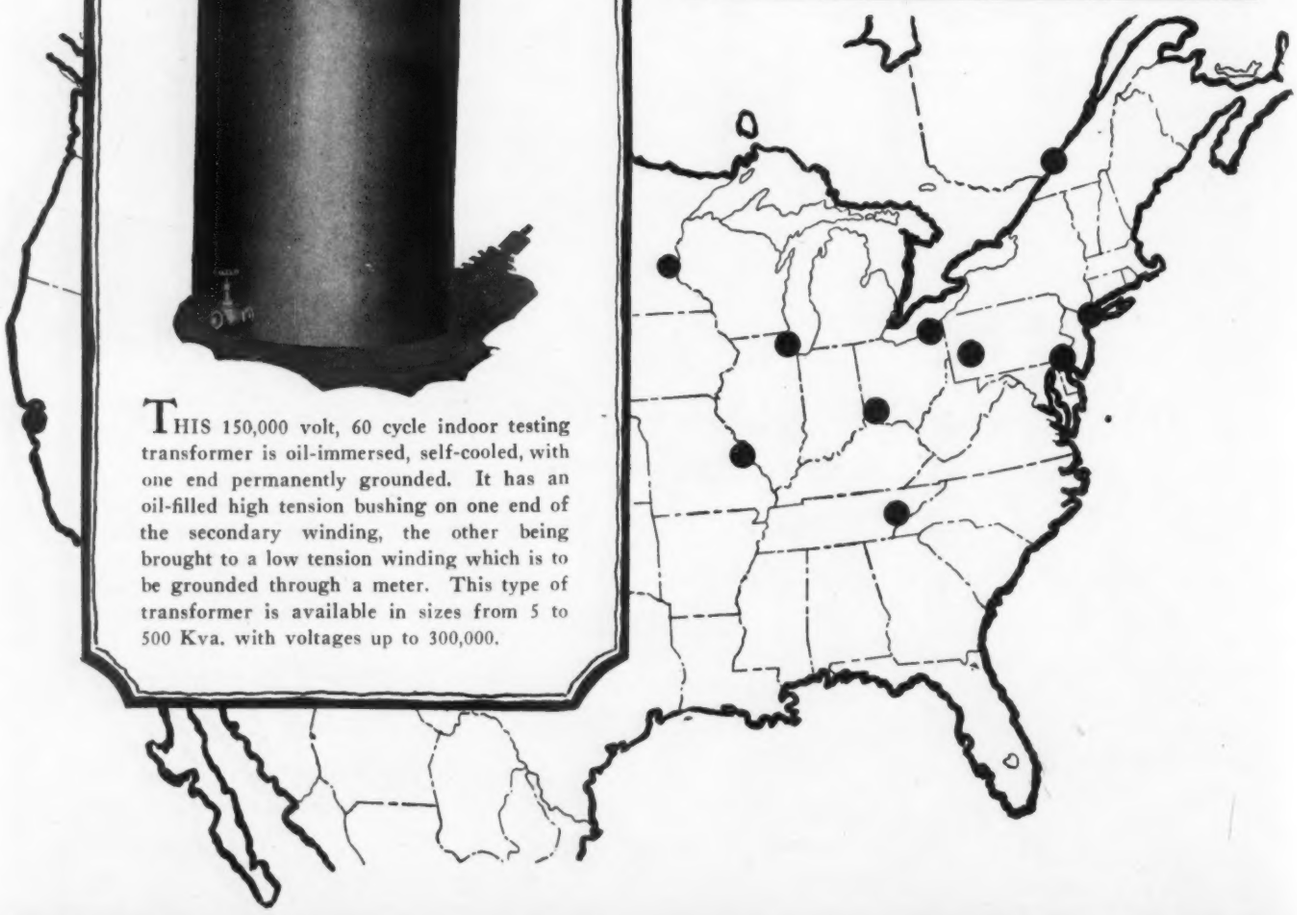
Better able to serve both Pub l

American Transformer Products

Transformers for

High Voltage Testing
Electrical Laboratories
Cottrell Precipitation
Heat Treating
Welding
Brazing
Oil Testing
Lighting and Power
Neon Sign Lighting
Broadcasting
X-Ray
Electro-Chemical Process
Phase Changing
Annealing
Integral Parts of Machines

THIS 150,000 volt, 60 cycle indoor testing transformer is oil-immersed, self-cooled, with one end permanently grounded. It has an oil-filled high tension bushing on one end of the secondary winding, the other being brought to a low tension winding which is to be grounded through a meter. This type of transformer is available in sizes from 5 to 500 Kva. with voltages up to 300,000.



AMERICAN TRANSFORMER

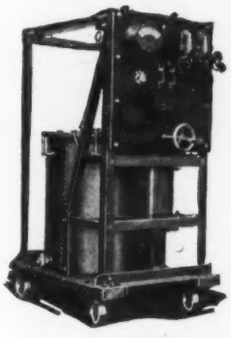
lic Utilities and Manufacturers

By establishing dependable sales representatives in different parts of the United States and Canada, the American Transformer Company is now able to give Public Utilities a better service on special transformers than ever before. This company has designed many special testing sets for central stations and has in other instances supplied the high voltage transformers for central station laboratories. Many electrical engineers find just what they are looking for among these testing sets. It is important to know that there is an American Transformer Testing Set that will meet almost any requirement. A set of bulletins will bring full details.

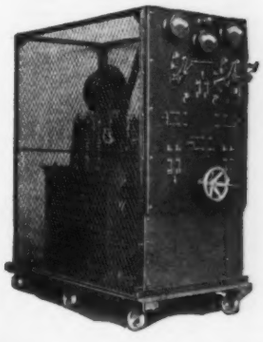
For years past, leading electrical manufacturers have used American Transformers in the making of varied products such as cable, insulators, cambric, paper cable, power transformers, appliances, instruments, etc.

Many other manufacturers use American Transformers as an integral part of an industrial machine or on switchboards or for electric heating applications, for electric furnaces and many other uses.

It is not possible to describe all of the special types of transformers being furnished for the many industrial applications. However, if you have an industrial transformer problem, let us have your specifications and we shall be pleased to recommend a transformer that will suit your purpose.



If you have a problem involving special transformer equipment, whether it be for cable testing, electric furnaces, heating, brazing, welding, dust precipitation, sign lighting, radio, electrical manufacturing or what not, we are now better able to serve you because of our additional sales representatives whose names and addresses are listed below. Whatever your problem, get in touch with our nearest representative, who is ready and willing to serve you.



AMERICAN TRANSFORMER COMPANY

178 Emmet Street, Newark, N. J.

SALES REPRESENTATIVES

Cleveland, Ohio
H. C. Boulton
1988 E. 66th St.

Cincinnati, Ohio
Congleton Engineering Company
914 Main St.

Minneapolis, Minn.
Elliott Equipment Company
708—6th Ave., S.

Pittsburgh, Pa.
Herr-Harris Company
910 Fulton Bldg.

Chicago, Ill.
L. C. Herrmann
4433 North Richmond St.
Ravenswood Station

St. Louis, Mo.
J. W. Jones
432 Pennant Bldg.

Philadelphia, Pa.
L. D. Joralemon
112 South 16th St.

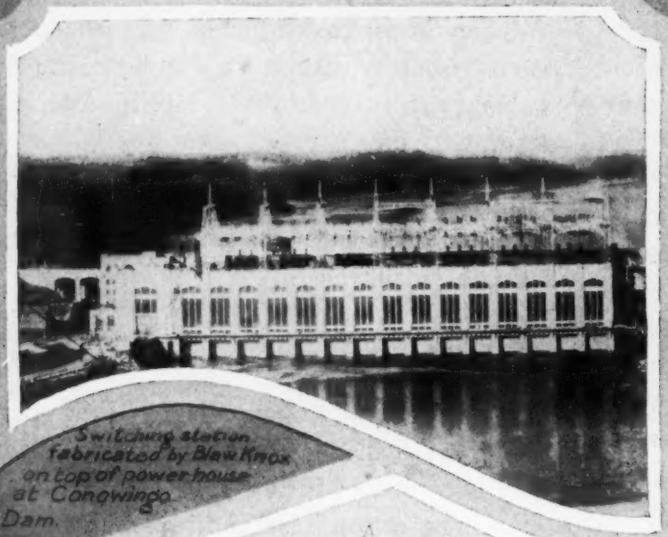
Knoxville, Tenn.
Arthur L. Pollard

San Francisco, Calif.
J. H. Southard
682 Mission St.

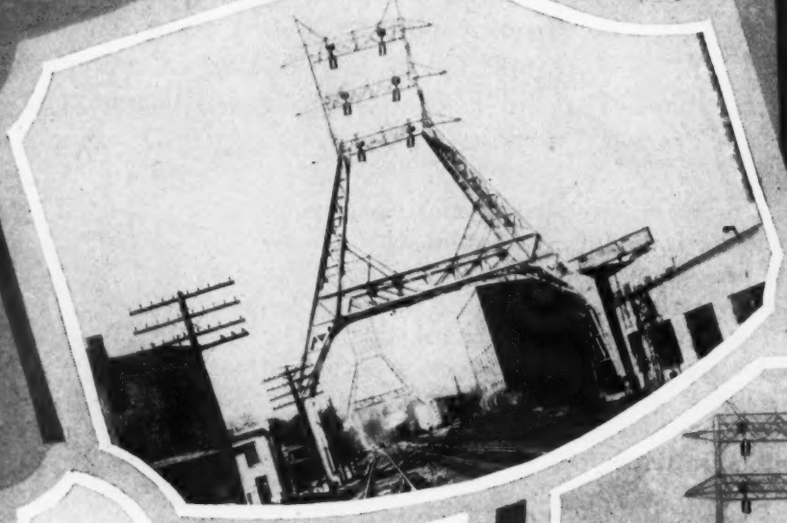
Montreal, Que., Canada
W. O. Taylor & Co., Ltd.
415 Canada Cement Bldg.

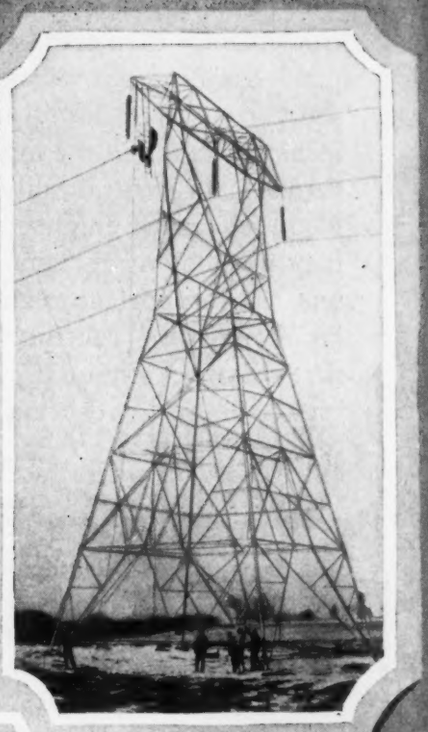
BLAW-KNOX TOWE

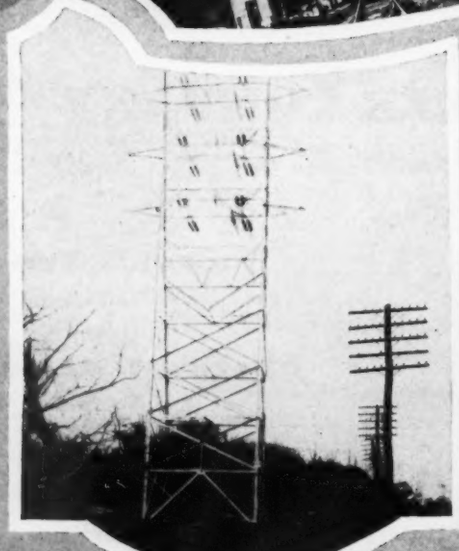
On the 220 KV
of Philadelphia

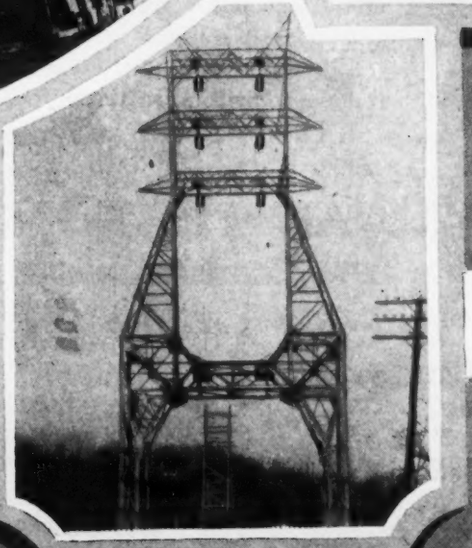


Switching station fabricated by Blaw-Knox on top of power house at Conowingo Dam.





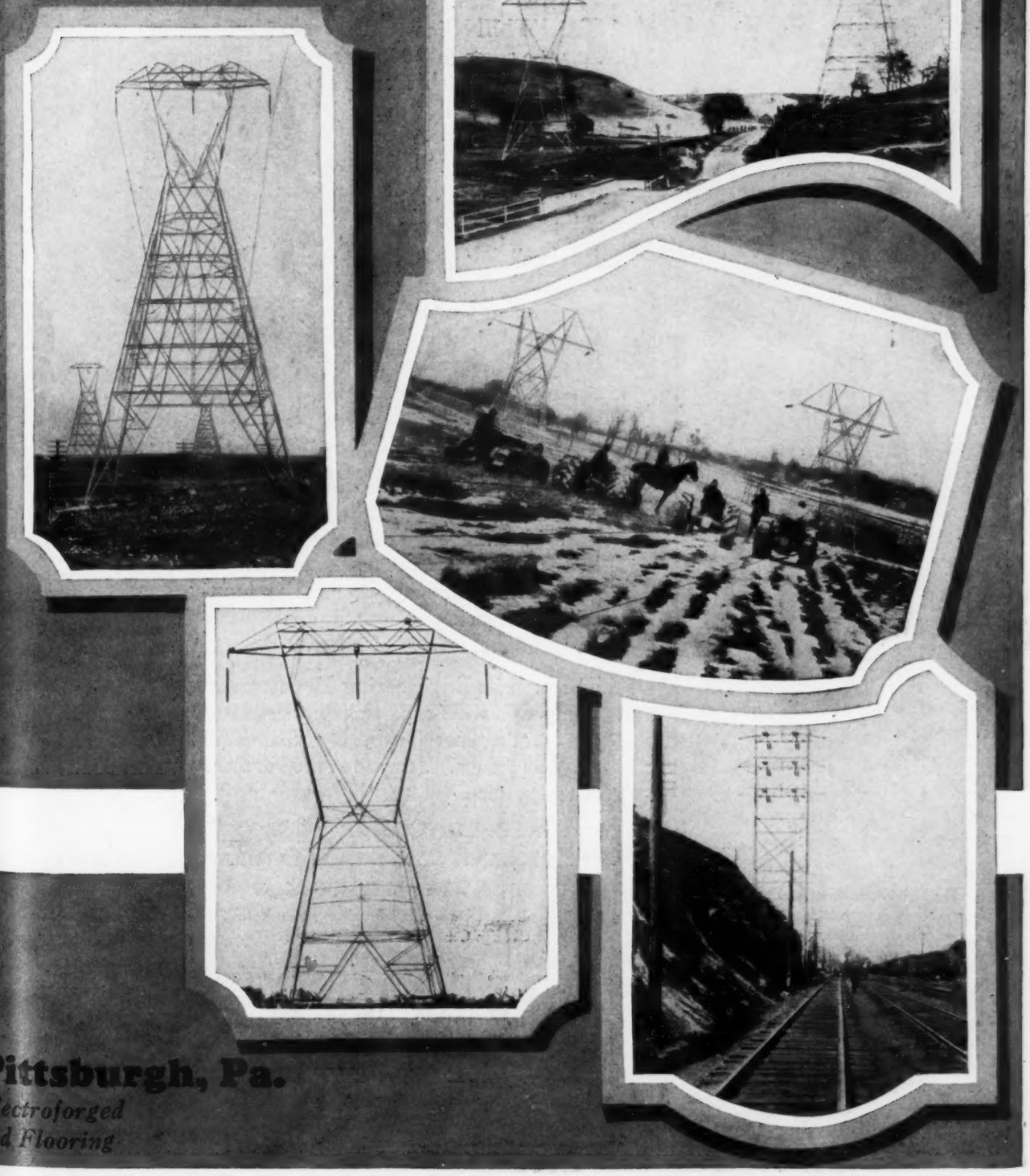




BLAW-KNOX CO.,
Manufacturers of
Steel Grating

RS AT CONOWINGO–

nd 66 KV lines
lectric Company



Pittsburgh, Pa.
Electroforged
and Flooring

The high conductivity and uniform quality of Anaconda Metals are the result of the coordinated supervision by a single organization of every process from ore to finished product. Six wire mills offer a coast-to-coast service unequalled for promptness and dependability.

Lightning burned away the outer strands —*yet the* Copper Cable *held fast!*

Use Copper for continuity of service

LIGHTNING caused flashover from one of the seven 500,000 c.m. stranded copper conductors which span the Niagara River. All of the outside strands were burned away. The inner strands *held*, and were of sufficient strength and conductivity to keep the line in operation until the damage could be found and repaired.

It is well known that copper and its alloys resist the effects of arcs better than other metals sometimes used for conductors. Copper will not support combustion after an arc has ceased and therefore does not constitute a fire hazard. These inherent advantages of copper should not be overlooked when considering transmission line conductors.

The cable referred to above is 7,000 feet long, weighs more than 11,000 pounds, and was made of continuous strands by The American Brass Company to specifications of the Niagara Falls Power Company. On test, the completed cable exceeded the specifications, providing an additional margin of safety.

Through its Engineering Department, the Company's wide experience in designing and constructing special cable is available to electrical engineers. You are invited to make use of this service.

ANACONDA COPPER MINING CO.
THE AMERICAN BRASS COMPANY

Rod, Wire and Cable Products

General Offices: 25 Broadway, New York
Chicago Office: 111 W. Washington St.

ANACONDA
WIRE PRODUCTS

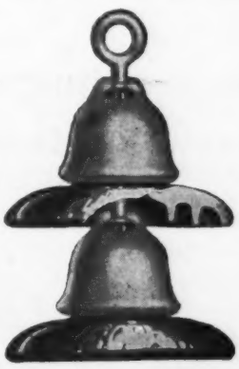
ANACONDA

"It's our moral obligation to do this"

Just as it is the duty of the manufacturer to supply a dependable product, so it is the moral obligation of the public utility to so equip as to furnish reliable service—always.

NOTHING can do more toward disrupting customer good-will in the electric light and power field than *interrupted service.* If you follow this up you find that nothing in the annual totals causes more *line outages* than faulty equipment, in which insulators must acknowledge a share. And continuing further, it is common knowledge that nothing contributes more to insulator mortality than faulty materials.

Thus, if either manufacturer or public utility uses inferior materials, public faith in the industry is jeopardized and customer good-will is lost or will be stubbornly resistant for some time to come. And so, the objectives of these two, the manufacturer and the public utility are synonymous. Neither can afford to make use of untried and untested materials.



The success of "Thomas" equipped transmission lines is sufficient evidence that *The Pioneer's* moral obligation to the public utility trade has been fulfilled. Being *made well,* Thomas Insulators may be depended upon to *serve well.* They remain faithful by withstanding the supreme test of line service under all conditions and over an extremely long period of years.

THOMAS INSULATORS

TRIED TESTED

NEW YORK ~ BOSTON
GRAYBAR ELECTRIC CO. Inc.
ON THE PACIFIC COAST.

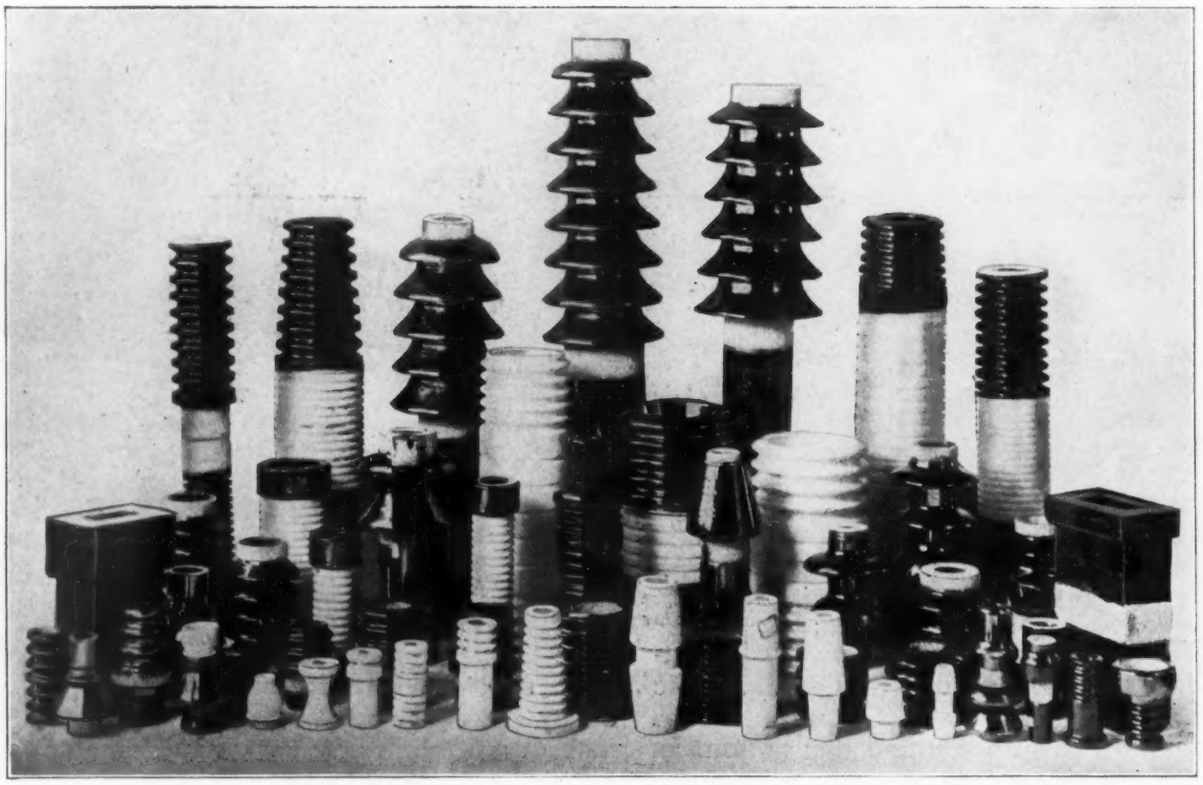
THE R. THOMAS & SONS CO.
LISBON, OHIO, U.S.A.
PIONEERING SINCE 1873

CHICAGO ~ LONDON
NORTHERN ELECTRIC CO. Ltd.
IN CANADA

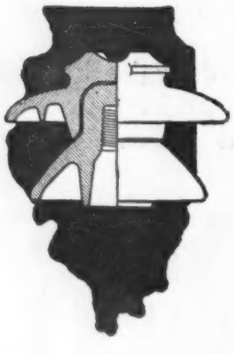
Electrical Manufacturers Depend On—

ILLI

PORCELAIN



Quality unquestioned—Dimensions precise—
Deliveries quickest



For these reasons—most prominent electrical manufacturers today look to Illinois for all or part of their porcelain requirements.

If you happen to be unfamiliar with Illinois' exceptional facilities for providing you with special porcelain shapes, we shall appreciate hearing from you.

Send us a blue print for price, delivery and free sample.

ILLINOIS ELECTRIC
MACOMB,

Electric Power Companies Specify—

NOIS

INSULATORS

Accurate design—Exact manufacture—Years in service

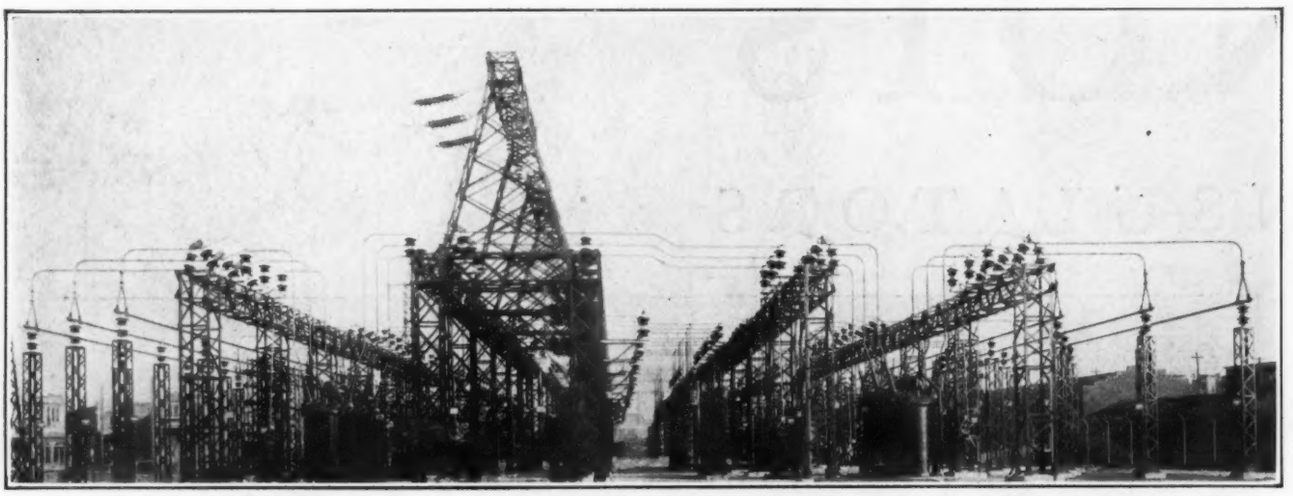
These are the vital considerations that are today prompting increasing numbers of our largest utilities to turn to Illinois for reliable insulators.

Many of them have become acquainted with Illinois quality through the use of our famous No. 2050 insulator—an unusually rugged unit especially designed by us for your important 33 KV. lines.

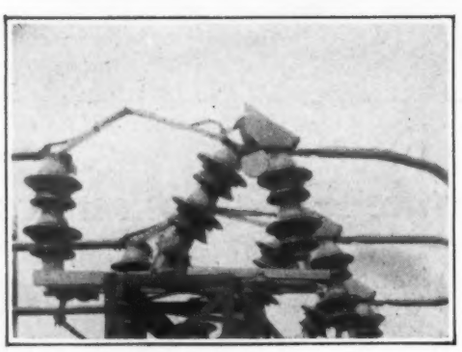
Write for a free sample of No. 2050—if you are not already using it.

PORCELAIN COMPANY
ILLINOIS

The Conowingo



The ELPECO Tie-in



ELPECO S-type switches are used in the 66,000-volt Westmoreland Substation of the Philadelphia Electric Company System pictured above. Coming over 66,000-volt lines from the Plymouth Meeting Substation, Conowingo and Interconnection power is here tied into the company's high-tension system.

These switches have one single tilting insulator stack—the insulators providing flashover (wet) at 285 kv. and are supported on a double channel section base. The bearings are heavy malleable iron with babbitt metal on which the square shaft rotates.

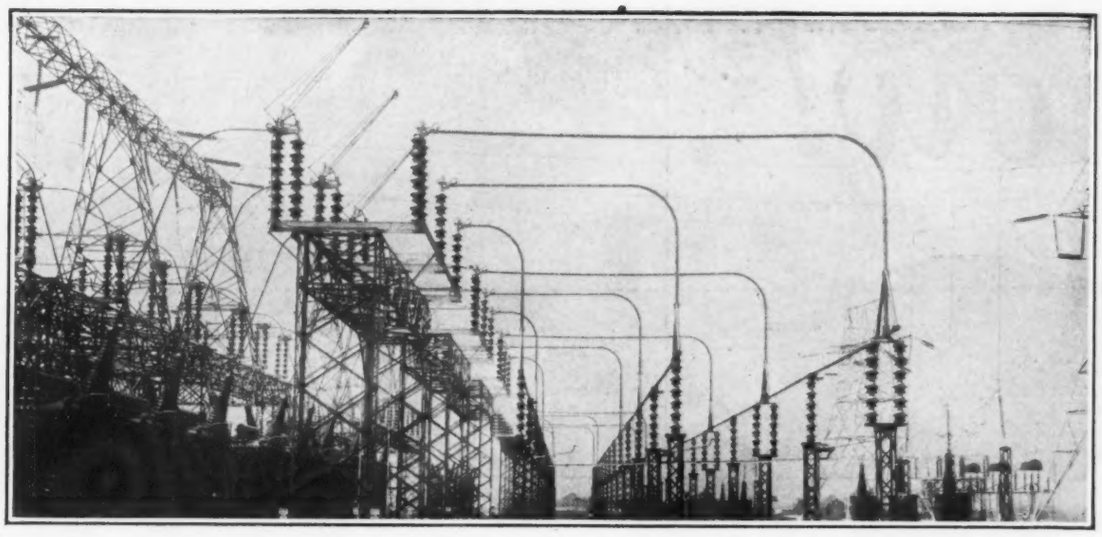
Contacts are full floating type equipped with sleet hoods.

Elpeco S-type switches are made for service on lines from 6,600 to 132,000 volts.

Our nearest district office will welcome a call for further information.

for the good of the Service

Tie-In

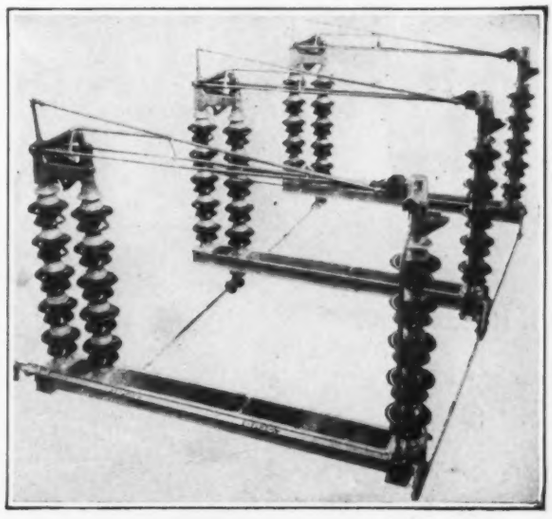


THE above view shows the important switching and transformer station at Plymouth Meeting, Pa., where energy at 220,000 volts is received from the Conowingo hydro-electric station and the Pennsylvania-New Jersey Interconnection.

Elpeco Edison Type Switches at this station are used throughout.

1. The blades are made of heavy iron pipe size copper tube, rigidly braced.
2. The second insulator stack rotates, lifting the blade in a vertical position from the contact.
3. Contacts are full floating type protected from sleet and dirt.
4. You will note that each switch is equipped with grounding blades which are always open when the main switch is closed. An interlock prevents grounding switch from being closed in on a live line.

The Elpeco Edison type switch is now in operation on all three of the 220,000-volt lines at present in service in the United States.

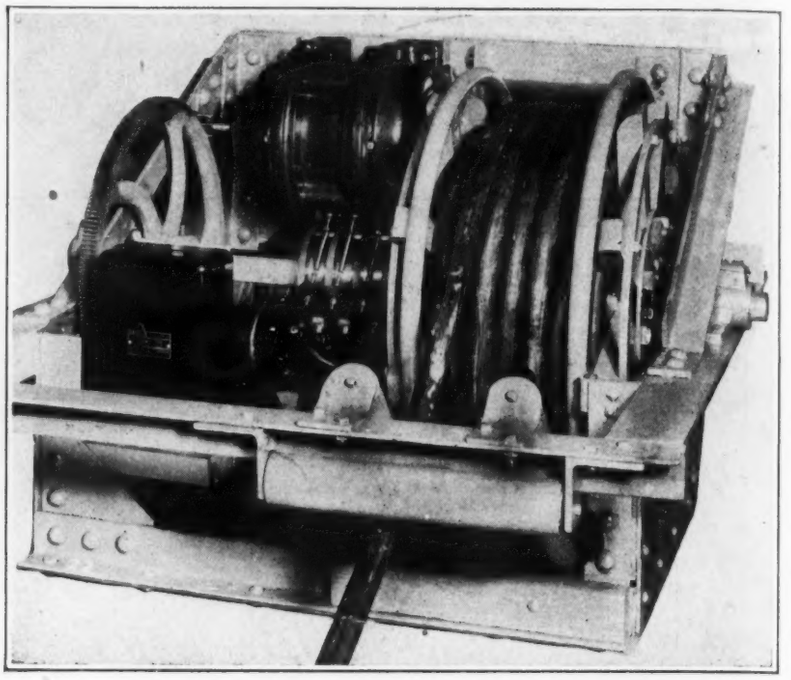


ELPECO

ELECTRIC POWER EQUIPMENT CORPORATION

412-420 NORTH EIGHTEENTH ST. PHILADELPHIA, PA.

and now!



a "GLEASON" with Motor Drive

To the already complete line of Gleason Continuous Contact Reels has been added a new member of high ranking.

It is the Gleason Motor Driven Continuous Contact Reel, and is especially efficient for eliminating cable slack when operating electric locomotive cranes and tractor-type excavators.

The reel driving mechanism and a special motor controlled by contact switches actuated by the driving clutches of the crane or tractor, are mounted on a steel frame.

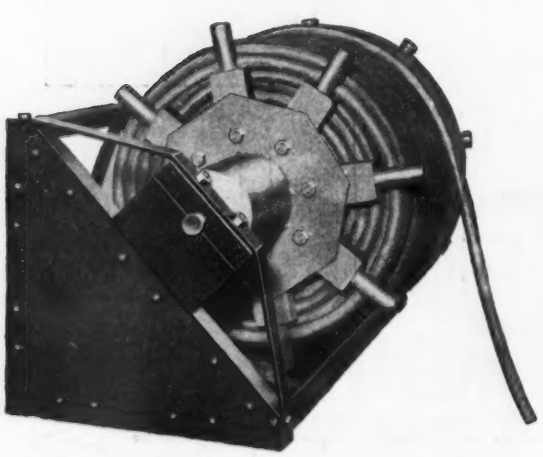
The motor is designed to remain in circuit for ten minutes while the machine is at a standstill. All operations are automatic.

The motor runs whenever the crane or tractor is in transit, the cable paying out against the motor torque when the machine moves away from the current supply base.

The reel shortly pays by eliminating a ground main for the cable.

The capacity of these reels are only limited by physical dimensions. A crane mounted on a tractor base usually limits to 150 to 200 feet of cable No. 4/0 to 1/0.

Plugs and Receptacles

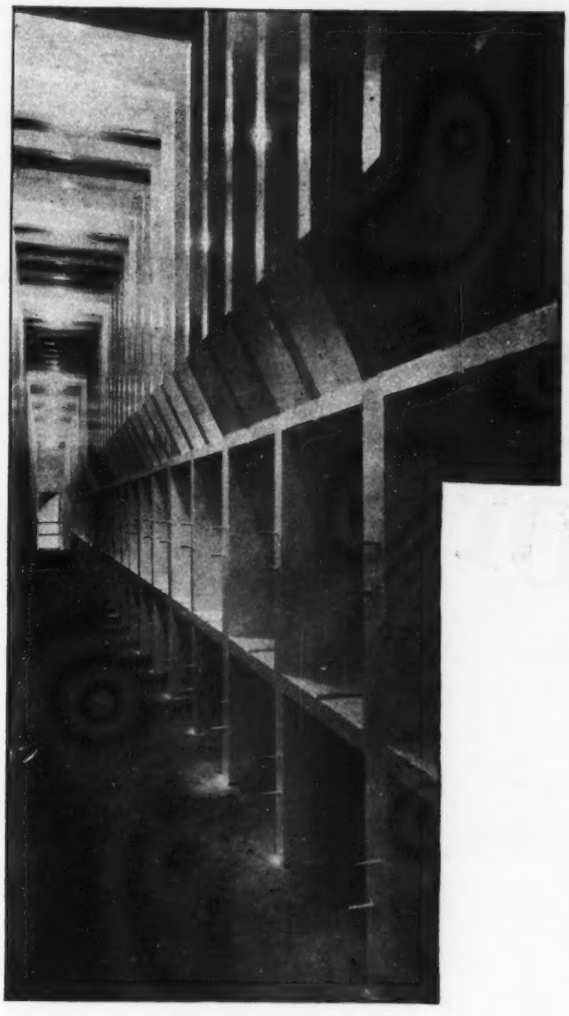


Type 20 and 21 Reel

Gleason folders and other descriptive matter will interest users of heavy duty portable electrical equipment. You may have them for the asking.

J. L. GLEASON & CO.

241 Franklin St.
Boston, Mass.



Barriers After Removal of Forms

Cutting the Cost of BUS CONSTRUCTION

By the use of Unit Steel forms we have reduced the cost of Bus Structures in Central Stations and Substations without sacrificing the quality of workmanship—and at a notable saving of time.

On one recently executed job we held the cost of Steel Forms down to

10 Cents a Sq. Ft. Against 40 Cents a Sq. Ft. on Wooden Forms

Our improved method of Bus Structures now makes possible

A Real Monolithic Structure at Lowest Cost

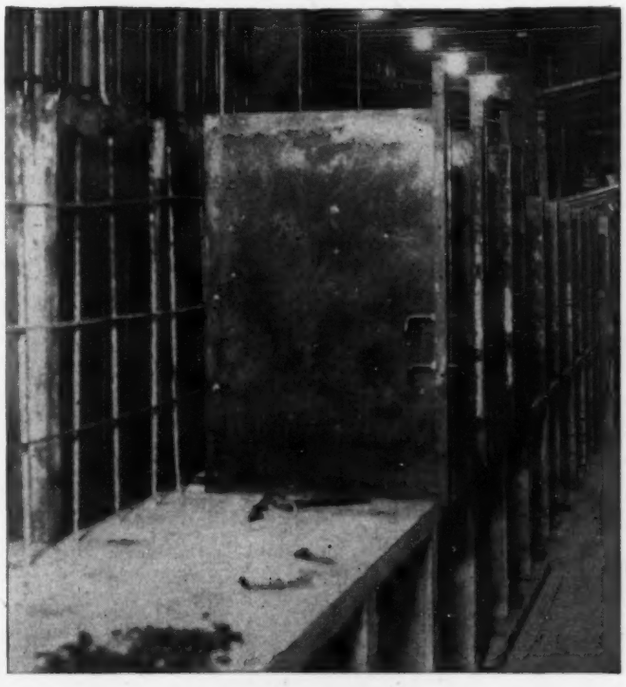
We invite opportunity to prove our claims.

Recent Contracts executed to the complete satisfaction of our clients:

United Electric Light Co.
Springfield, Mass.
Holyoke (Mass.) Water Power Co.
Cumberland Co. Power & Light Co.
Portland, Me.
Rockland Light & Power Co.
Nyack, N. Y.
Salem (Mass.) Electric Lighting Co.
Malden (Mass.) Electric Light Co.
Youngstown (O.) Sheet & Tube Co.

THE BUS STRUCTURE COMPANY

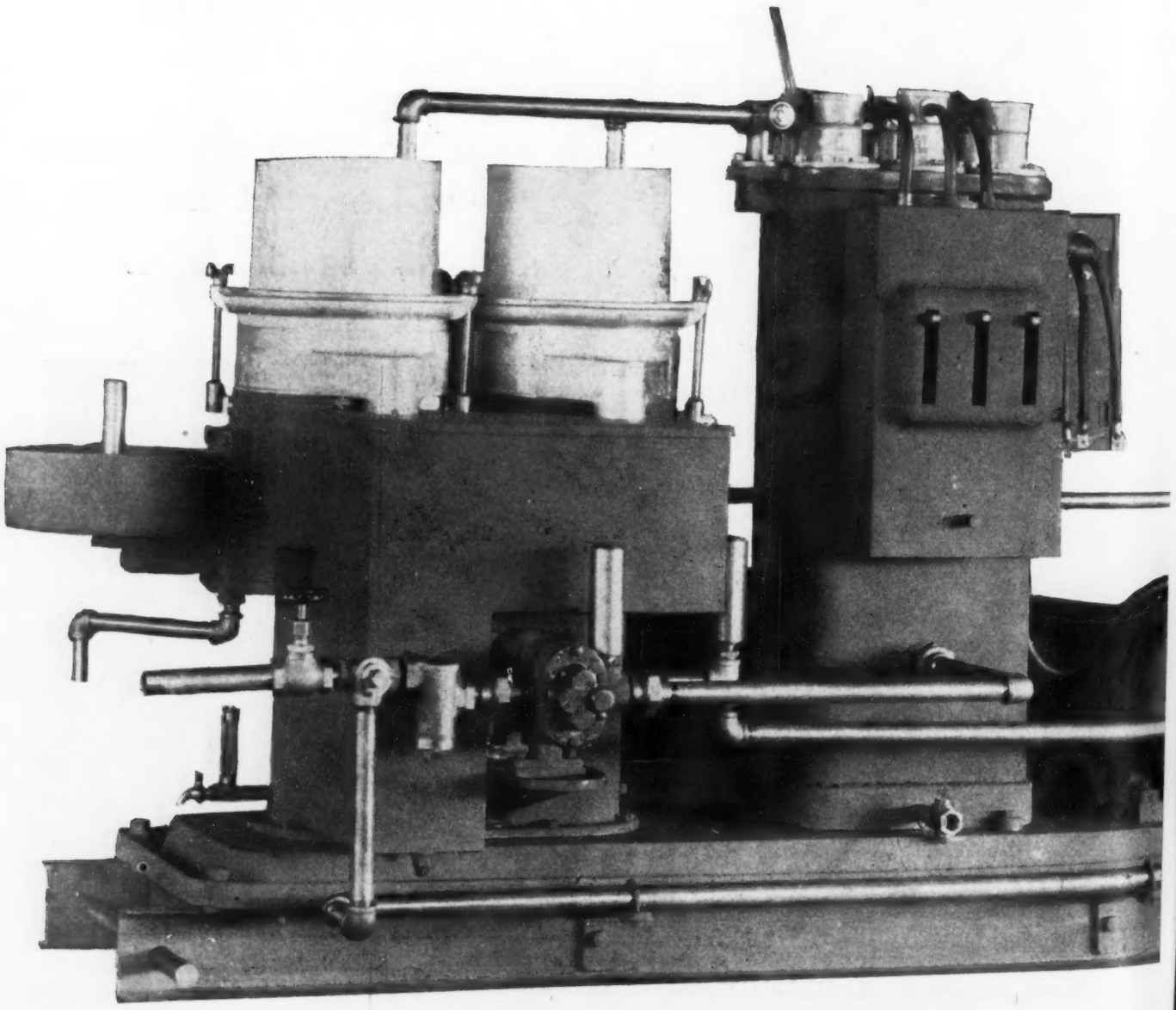
21 Besse Place
Springfield Massachusetts



Steel Forms Ready for Pouring

Hydroil

protector of your



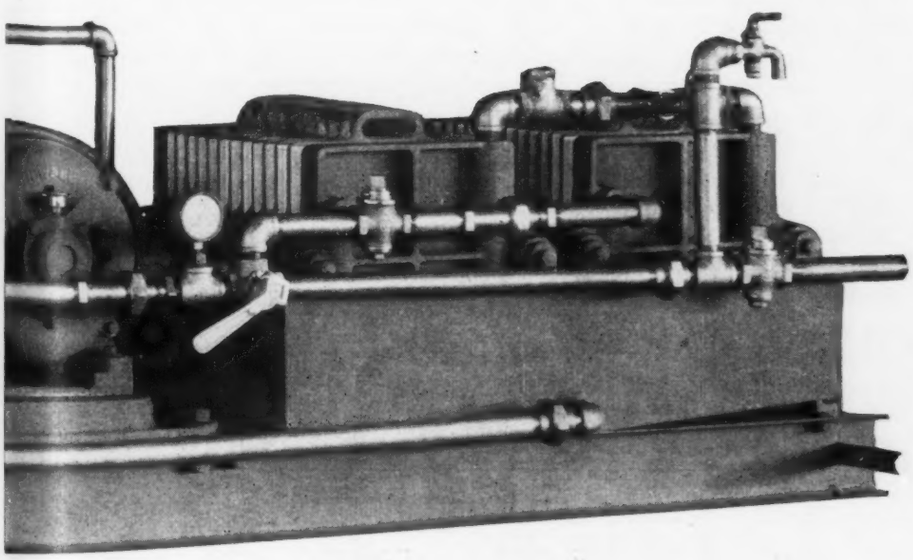
transformer investment

THE large investment of central stations in transformers and other oil-insulated equipment calls for the utmost protection against the hazard of burnouts. The Hydroil offers this complete protection, and in the most efficient form possible. One continuous passage through this machine restores insulating oil to its maximum inherent dielectric strength, no matter what its condition before purification.

There is a Hydroil for every oil-purifying requirement. Models both stationary and portable. Continuous test cup for proving all oil that has been purified is supplied at extra cost.

Write for details.

Hydroil
CORPORATION
Lebanon Indiana



HYDROIL REPRESENTATIVES

Power Equipment Company,
250 Stuart Street, Boston, Mass.

Lee Skipwith & Co.,
369 Lexington Avenue, New York, N. Y.

The Bradley Company
2401 Chestnut Street, Philadelphia, Pa.

E. S. Stickle Company,
934 Union Trust Building, Pittsburgh, Pa.

E. S. Stickle Company,
342 Rockefeller Building, Cleveland, Ohio

E. S. Stickle Company,
40 Seneca Street, Buffalo, New York

W. D. Hamer Company,
518 Traction Terminal Bldg., Indianapolis, Indiana

John A. Clark Electric Company,
624 Baker Bldg., Minneapolis, Minnesota

H. D. Stier,
120 Marietta St., Atlanta, Ga.

Elgin B. Robertson,
711 Southwestern Life Bldg., Dallas, Texas

Farnham & Cunningham,
307 South Hill Street, Los Angeles, California

H. M. Thomas Company,
589 Howard Street, San Francisco, California

Powerlite Devices, Ltd.,
124 Richmond Street, Toronto, Ontario, Canada

It's more simple to order

SOLDERING LUGS

*from the Terminal * Headquarters*

The Right Lug for the Smallest Requirement to the Largest Substation

Standard

You save money using these lugs because they were specially designed by experts who know every need and made these Lugs to be most practical.

Ours is a complete and standard line offering greatest efficiency. Design and dimensions have been carefully worked out. Sherman Soldering Lugs are approved and listed by the Underwriters' Laboratories. They are marked with the N. E. C. rating in amperes across the flat portion at the wire end. They are made of seamless copper of exactly correct gauge—better conductivity recured—most practical.

*Headquarters for Terminals

Sherman makes a high quality, complete, and economical line of terminals for the ends of cables and wires. They are now generally accepted as the proper terminals to use because of their exclusive features, advantages, and economy. Ask for descriptive literature.

Send for Bulletin No. 17 descriptive of our Heavy Duty Soldering Lugs. Also request complete Electric Catalog.

HEAVY DUTY

We have perfected a complete standardized line of Heavy Duty Soldering Lugs of adequate size and strength to meet every mechanical and electric need.

The general finish shows the great care used in their manufacture. Specialized methods, together with latest type of machinery and tools insures the highest standard of quality. Each lug is plainly marked on the barrel with the word "Sherman" and the number.

Obtainable in sizes to accommodate wire from No. 19/22 to 2,000,000 C. M.

Furnished blank or with regular stud holes.

These six points assure complete satisfaction: 1, Flat contact surfaces. 2, Made to N. E. L. A. specifications. 3, Free from burrs and other faults. 4, Seamless extra heavy copper tubing used. 5, Dimensions carefully maintained. 6, Sturdy and dependable.

Manufacturers who have investigated don't bother with the old practice of making their own Lugs. Central stations are accepting Sherman Lugs as the most practical and economical. Our line is such that the soldering lug problem for all users has been simplified. You get the finest lugs possible from H. B. Sherman Mfg. Co. because we have studied the lug situation and have designed our lugs for every possible need.

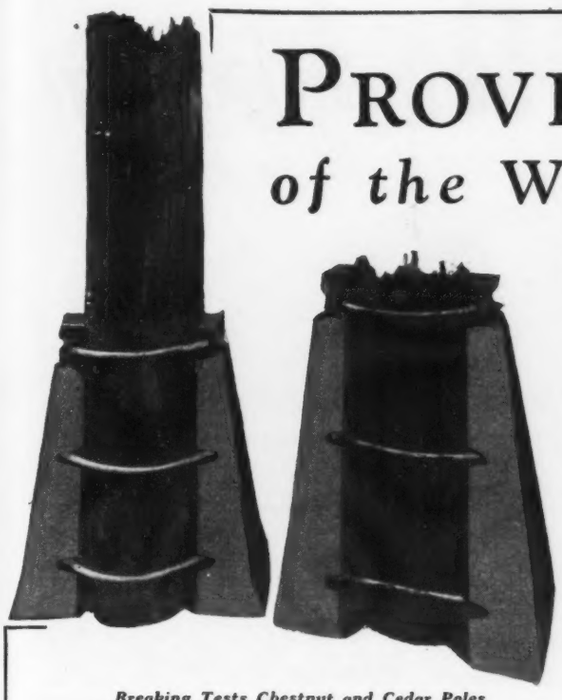
Look for SHERMAN HEAVY DUTY Soldering Lugs on the Electrical Equipment you buy.

The manufacturer who equips his apparatus with Sherman Heavy Duty Soldering Lugs protects the user. You can be sure when they are Sherman Lugs.

SOLD THROUGH JOBBERS

H. B. SHERMAN MFG. CO.
Battle Creek, Mich.

PROVING STRENGTH
of the Williams Pole Mount



Breaking Tests Chestnut and Cedar Poles

THE illustration demonstrates conclusively that the Williams Pole Mount has ample strength for the job—whether required for construction with new poles, or where butt-decay has weakened the poles in a comparatively few years far below the maximum strengths shown in these tests. If new poles may be broken in the Pole Mount without injuring it and if butt-rotted poles may be restored to original strength, then greater strength is not required.

Use Williams Pole Mounts for economy as well as for strength. Costly changeover expense eliminated, also blasting for rock locations. No interruption of service.

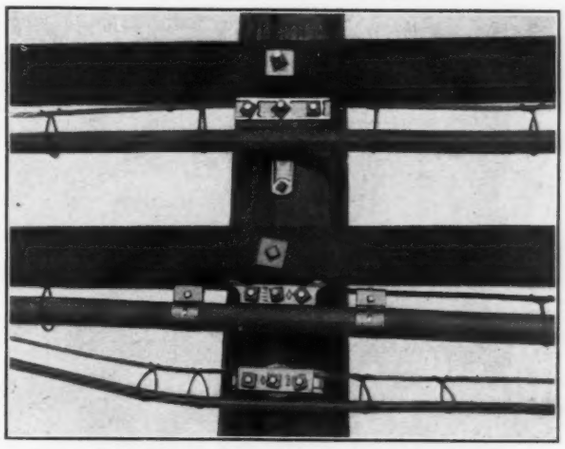
The new chestnut pole at the left, measuring 14 in. in diameter at butt, was tested with gradually increasing strain applied 21 ft. 6 in. above ground, developing a maximum resistance of 3300 lbs. before breaking. The No. 1015 Pole Mount withstood satisfactorily the resulting turning or crushing load of 70,950 ft. lbs.

The new cedar pole, also measuring 14 in. at the butt, was similarly tested by a prominent light and power company, developing a maximum resistance of 1400 lbs. with loading applied 39 ft. above ground. The resulting turning and crushing load borne by the larger No. 1500 Pole Mount was 54,600 ft. lbs. This is oversize Mount for the pole used.

Among the other M.I.F. Pole Hardware listed below, the newly developed lines of Clamps and Insulator Hangers for suspending aerial cable from messenger wire will prove well worth investigation. A decided step forward in aerial cable suspension practice. The illustration to the right shows three types of Cable Suspension Clamps for direct pole mounting. Other types available for crossarm mounting. Note Bonding Clamp at either side of pole below lower guard-arm.

Other M. I. F. Pole Hardware

Williams Pole Mounts for Tubular Iron Poles.
Reinforcing and Extension Clamps for Tubular Iron Poles.
Malleable Iron Crossarm Gains for Wood and Tubular Iron Poles.
Cable Suspension Clamps—Under-arm, Over-arm and Direct Pole Mounting Types.
Cable Insulator Hangers.
Catenary Clamps.
Tension Pulling Device.
Shull Boltless Guy Clamps.
Wood Pole Top Extensions.
Special Galvanized Structural Steel Shapes.



Demonstration Installation of Cable Suspension Clamps.
Top—Heavy Duty Center—Medium Duty
Bottom—Corner Type

Send for full data on items of interest.

MALLEABLE IRON FITTINGS COMPANY

Pole Hardware Department

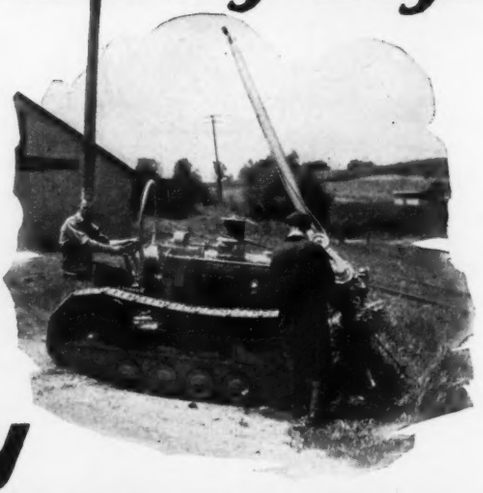
Factory and New England Sales Office: Branford, Connecticut
New York Sales Office: Thirty Church Street

General Sales Agents elsewhere in U. S.:
LINE MATERIAL COMPANY, South Milwaukee, Wis.
Canadian Distributor: Canadian Line Materials, Limited, Toronto

The "HIGHWAY" Bores At Any Angle

Save $100.00 or more a day on LINE CONSTRUCTION

Model "D" Highway Earth Boring Machine mounted on crawler equipped tractor, complete with Pole Derrick and Capstan Winch, priced at $5,000 F. O. B. Edgerton.



Model "C" Highway Earth Boring Machine for truck mounting, priced at $3,428 F. O. B. Edgerton—Pole Setting Equipment extra.

with The Highway Earth Boring Machine

Two dollars saved on every pole set! What does that mean in the aggregate on your total year's construction and maintenance work?

It may mean that you can pay for the installation of the Highway Earth Boring Machine and Pole Setting Equipment several times over out of the saving.

It certainly means a handsome return on the investment, and the whole story of the benefits that you will receive from your "Highway" equipment is by no means told in a simple statement of saving of cost of construction.

There is the much greater speed—fifty or more poles set each working day; the greatly reduced crew—three men are all that are required to operate the "Highway"; and the uniform quality and efficiency with which the work is done—the "Highway" bores accurately to any depth up to 10 feet and in any kind of soil.

Can you afford to delay your investigation of this wonder machine?

HIGHWAY TRAILER CO.

Home Office At Edgerton, Wis., U. S. A.

BRANCHES

1939-33 W. VAN BUREN ST. CHICAGO, ILL.
1801 N. MARKET ST. DALLAS, TEXAS
5307-9-11 LANSDOWNE AVE. PHILADELPHIA, PA.
5606 CURTIS AVE. CLEVELAND, OHIO
207 MINNIE ST. DETROIT, MICH.

Installation Time

"A Better Accessory for Every Service and Better Service from Every Accessory"

The
STANDARD
Line Includes:

Indoor Terminals
Outdoor Terminals
Junction Boxes
Joint Boxes
Jointing Materials

in addition to

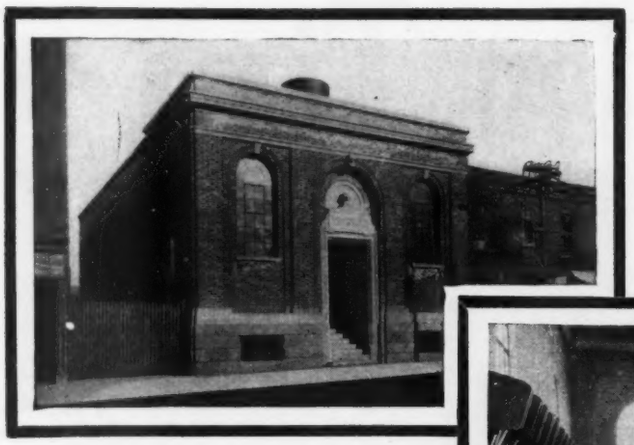
Wires and Cables of all kinds

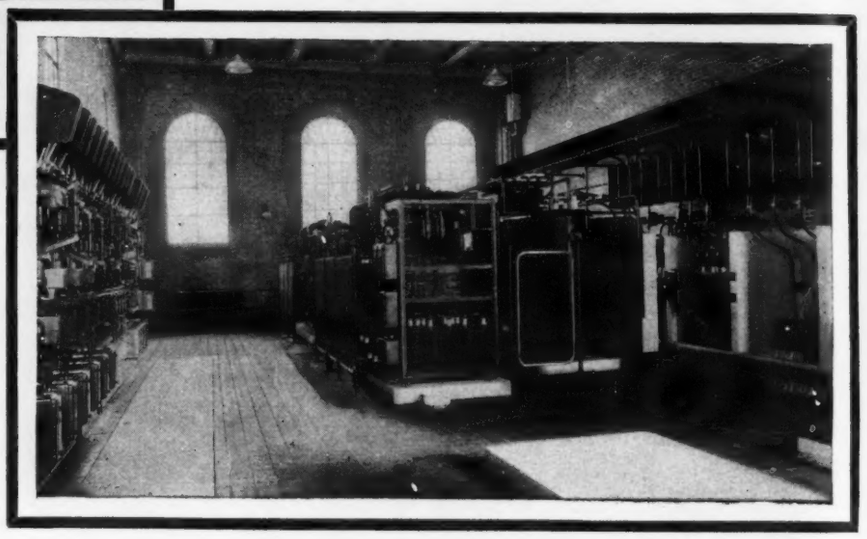
Install STANDARD Cable Accessories as well as STANDARD Cables when designing your electric cable system!

Standardize on STANDARD!

Write our nearest office for Cable Accessory Catalogues.

STANDARD UNDERGROUND CABLE CO.
Division of General Cable Corp. General Offices: PITTSBURGH, PA.
BRANCH SALES OFFICES
Boston New York Philadelphia Washington Atlanta Pittsburgh Detroit
Chicago St. Louis Kansas City San Francisco Los Angeles Seattle





A 3,600 kw., 600 volt, full-automatic, A-B-B Mercury-Arc Power Rectifier Substation in Verdun near Montreal, Canada. Primary supply is 12,600 volts, three phase, 60 cycle.

A-B-B Mercury-Arc Power Rectifiers *in Canada*

This efficient, silent, full-automatic substation providing direct current to the Montreal Tramways Co. is typical of not a few substations now in daily operation at many points in the Dominion of Canada as well as in the United States.

Total installed and operating capacities of A-B-B stations in both of these countries have now reached the impressive total of 50,000 kilowatts. Each passing month sees this total mount.

Your attention is also invited to the fact that this company is in a position to study your requirements on any of the types of equipment listed below.

AMERICAN BROWN BOVERI ELECTRIC CORPORATION
Camden, N. J. Graybar Bldg., New York City

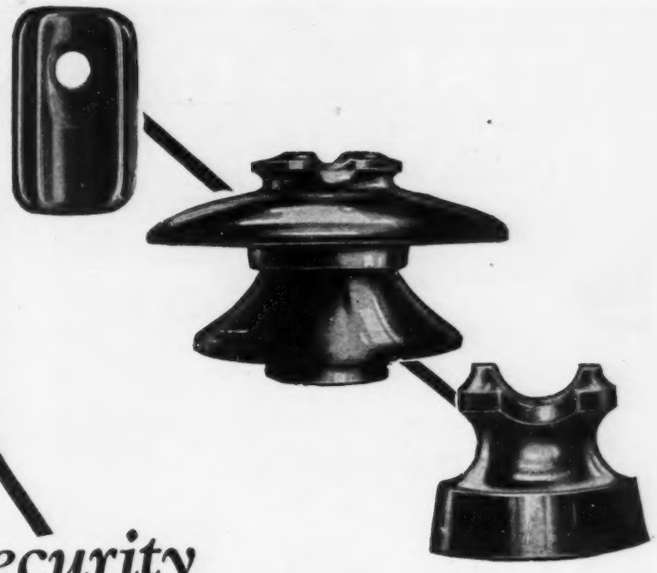
Steam Turbo-Generator Sets
Mercury-Arc Power Rectifiers
Transformers
High Voltage Oil Circuit Breakers
Synchronizers

Automatic Voltage Regulators
Electric Locomotives
Turbo-Compressors and Blowers
Complete Substation equipment
Car Lighting Equipment

Multiple Unit Car equipment
Subway Traction equipment
Diesel-Electric Locomotives
Scavenging and Supercharging Blowers
Turbo-Boosters and Exhausters

AMERICAN BROWN BOVERI

Franklin High Voltage Porcelain Insulators



Security —all along the lines

Franklin Porcelain Insulators are manufactured in a modern plant devoted to the production of wet process porcelain exclusively. Special care is given to the selection and testing of raw materials. In an up-to-date laboratory every insulator is given a thorough mechanical and electrical test before shipping.

That's why Franklin Porcelain Insulators will give long, trouble-free service on your lines. You can depend on them for a long life-time of service.

Whatever your high-voltage insulator requirements may be, we can efficiently and economically meet your needs.

Send for further particulars—and for an ESSCO salesman to go over your job with you.

Send for Bulletin No. 223

FRANKLIN PORCELAIN CO., Norristown, Pa.

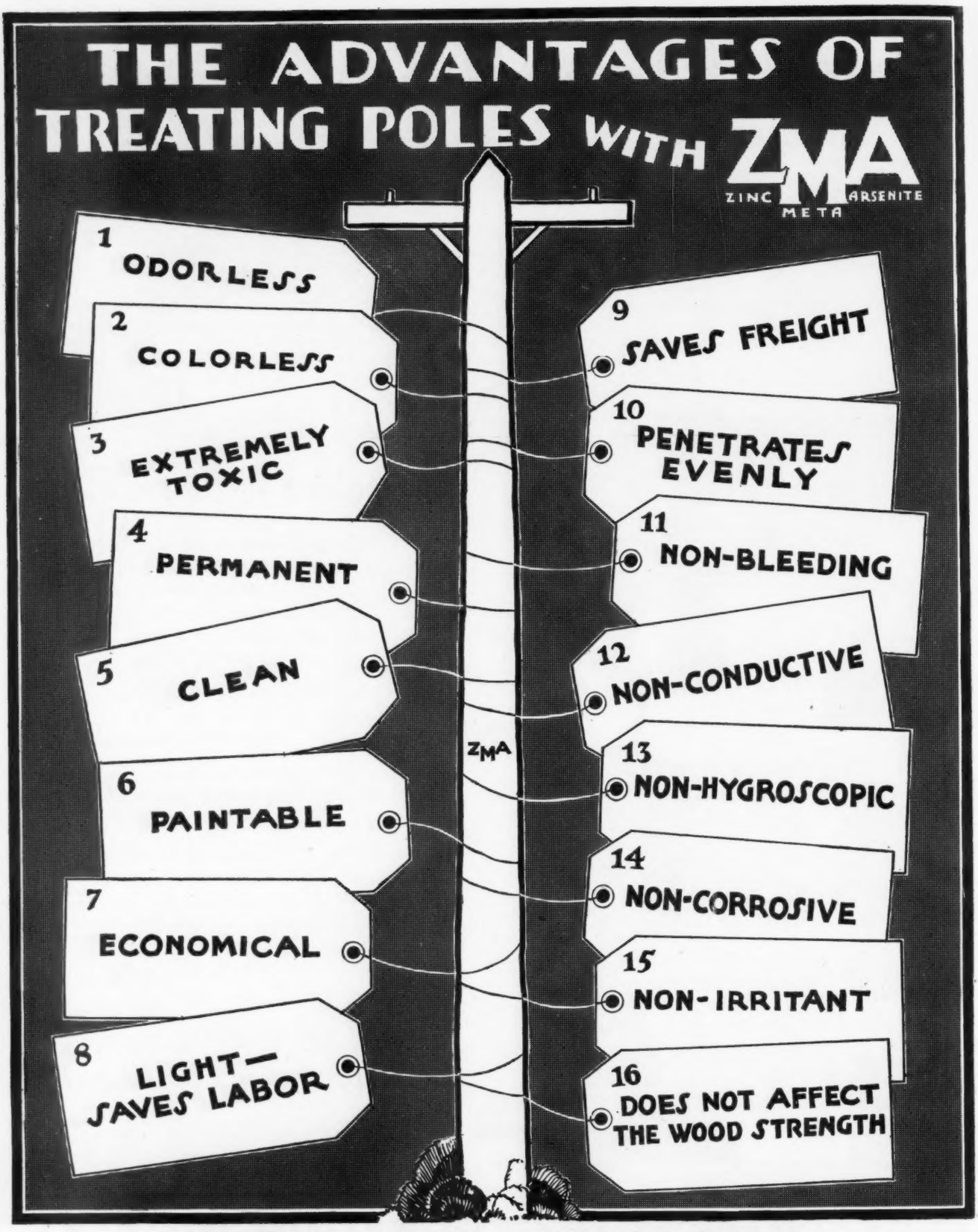
ELECTRIC SERVICE SUPPLIES CO.

Sales Agents

Home office and plant at 17th & Cambria Sts., PHILADELPHIA; District Offices at 111 North Canal St., CHICAGO; 50 Church St., NEW YORK; Bessemer Bldg., Pittsburgh; 88 Broad St., Boston; General Motors Bldg., Detroit; 316 N. Washington Ave., Scranton; Canadian Agents: Lyman Tube & Supply Company, Ltd., Montreal, Toronto, Vancouver.

ELECTRIC SERVICE SUPPLIES CO.

MANUFACTURER OF RAILWAY, POWER AND INDUSTRIAL ELECTRICAL MATERIAL



CURTIN-HOWE CORPORATION

TIMBER PRESERVATION ENGINEERS

11 PARK PLACE

NEW YORK CITY

Crozier Bldg., Philadelphia, Pa. *New Orleans Bank Bldg., New Orleans, La.*

A complete line of WESTINGHOUSE Control Bus & Power Batteries

In Westinghouse Control Bus and Power batteries the feature of annealed or pressed glass jars was pioneered. The plate or element supports are moulded integral with the jar. All types and sizes are of the sealed-in-type design, eliminating acid spray and excessive evaporation. These jars stand up under vibration and withstand wide variations in temperature.

Our engineers are at your service on control battery problems. No obligation to you.

Emergency Lighting, Marine, Time Clock, Telephone and Telegraph, Farm Light Batteries.

Catalogue 5000-B gives complete data on various types and sizes of power batteries. Write for copy.

WUBCO BATTERY CORPORATION

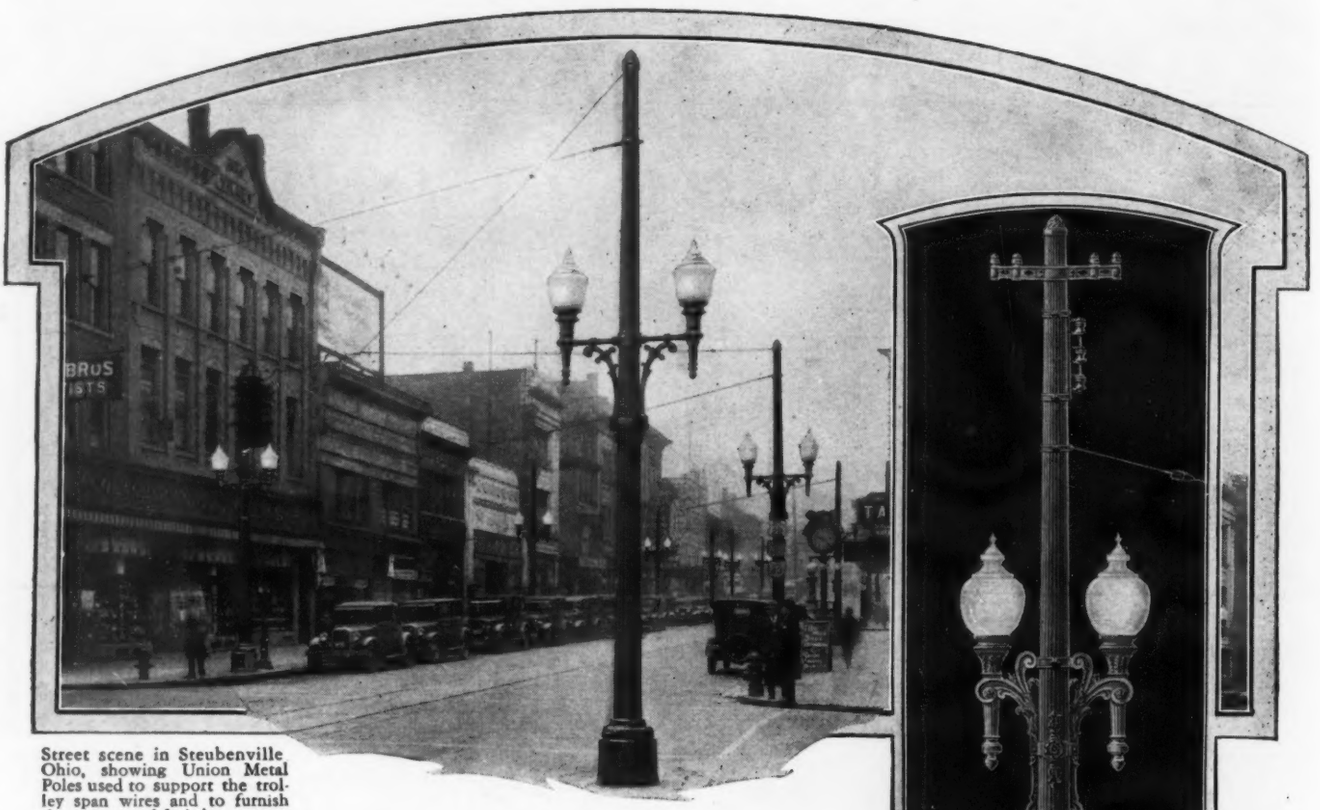
SWISSVALE, PA.

BRANCHES

CHICAGO, ILL.
323 W. POLK ST.

OAKLAND, CAL.
ELMHURST & SUNNYSIDE

NEW YORK, N. Y.
150 BROADWAY



Street scene in Steubenville Ohio, showing Union Metal Poles used to support the trolley span wires and to furnish the ornamental lighting system.

Union Metal Poles Mean Longer Pole Life

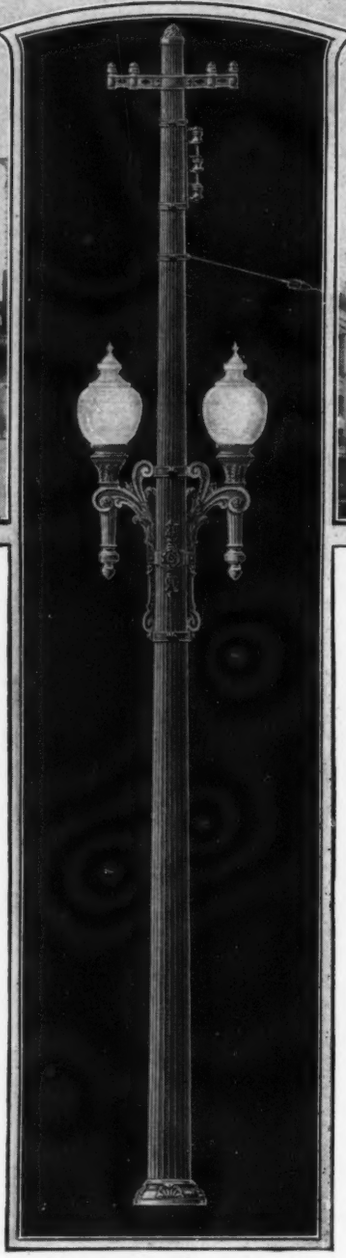
EMBODIED in Union Metal Fluted Steel Poles are new principles of strength and durability which assure longer pole life than any other type of pole yet produced.

Union Metal Poles are pressed from heavy, deep drawing stock steel and fluted to give additional strength. Exclusive Union Metal features provide for continuous ventilation of the pole, the elimination of sweating and condensation, and the decrease of the hazard of ground line corrosion. Every known engineering advantage has been included.

Many different types of these new poles are available, for use in all manner of service, urban or rural. Due to their attractive appearance, Union Metal Poles are especially desirable for use in city streets. They effectively decrease the number of poles along the curb line and harmonize well with city architecture.

Complete information regarding these unique poles will be sent on request.

THE UNION METAL MANUFACTURING CO.
General Offices and Factory: Canton, Ohio
Branches — New York, Chicago, Philadelphia, Cleveland, Pittsburgh, St. Louis, Los Angeles, San Francisco, Jacksonville.



Illustrating how Union Metal Poles can reduce the number of poles along the curb line with real beauty and utility.

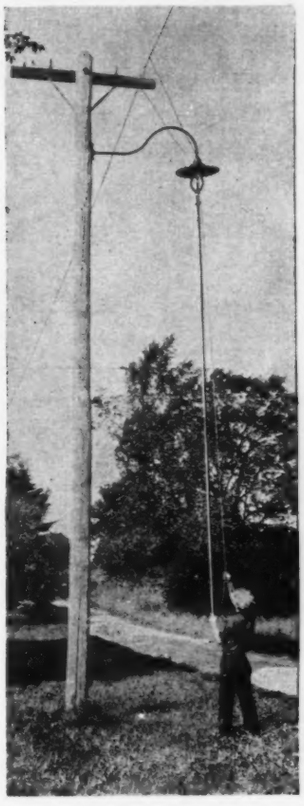
UNION METAL

THE ORIGINATORS AND LARGEST PRODUCERS OF

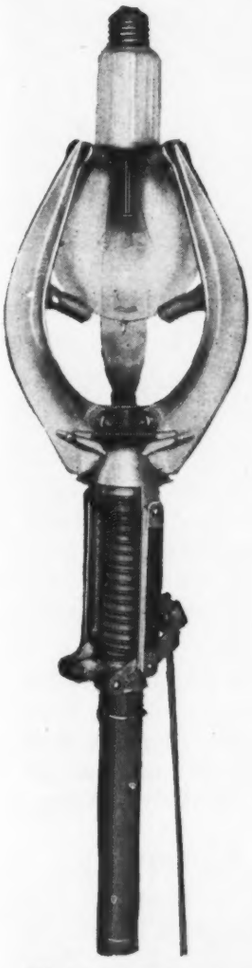
ORNAMENTAL LAMP STANDARDS

The G.C.A. Lamp Replacer

Safer for the men and much better for them to use



Reduces maintenance charges for the company



Model D Replacer
For Multiple Lamps

for series or multiple lamps and lamp bases

for series or multiple lamps and lamp bases, G.C.A. Lamp Replacers and Lamp Base Removers are well worth the careful consideration of every public utility distribution engineer for two very important reasons.

1. They enable your maintenance man to do more than twice the amount of work he would normally be capable of doing.
2. They protect your maintenance man from danger while he is doing the work.

When you stop to consider the low cost of replacing lamps the G.C.A. way as compared with the old method of carrying around a ladder, it is easy to understand why so many of the leading companies have adopted as standard the G.C.A. method.

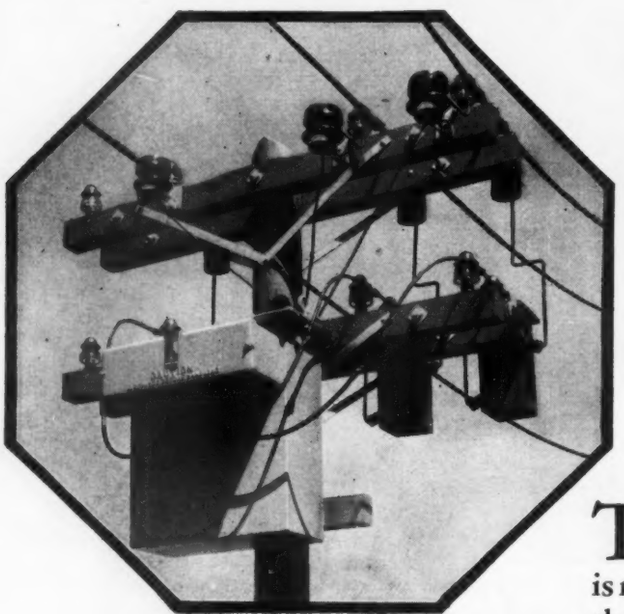
By equipping your men with G.C.A. Replacers, Fuse Plug Pullers and Lamp Base Removers, you will be giving them safe, convenient and practical tools to do their work cheaper and better. These simple tools will pay for themselves many times over. We have a catalogue giving full details and prices which we shall be pleased to send you upon request.

Model FP-1
Fuse Plug Puller

The G.C.A Manufacturing Co., Pittsfield, Mass.

Your lines

~make them carry profit making load only !



E-M has specialized in the application of Capacitors. The E-M specialist near you will be glad to help analyze your needs and supply you with complete information on the correction of low power factor. Your calling him in involves no obligation

E-M construction, fully patented and exclusively E-M, is the secret of the long-life, reliability and high efficiency of these Capacitors. An E-M representative will be glad to show you this construction and discuss its advantages

THE ever increasing use of motor-driven household appliances materially raises the load but is mighty upsetting to power factor. Reactive kv-a., the unprofitable component of the kv-a. load, quickly brings the lines up to the limit of their current-carrying capacity.

Let E-M Capacitors supply the reactive kv-a. *at the point where needed,* out in the residential districts—leaving your lines free to carry profit-making kilowatt load *only.* The result is less line loss and voltage drop, better regulation, greater capacity from generating and transforming equipment, and the saving from eliminating or postponing the need for new lines.

Units of the E-M type, totaling over 150,000 kv-a., have long since proved the dependability of the E-M method of construction and assembly. Compactness, and the air, oil and water-tight boiler plate steel tank, make the E-M Capacitor splendidly suited to pole mounting.

Electric Machinery Mfg. Company

Specialists in Apparatus for Power Factor Improvement

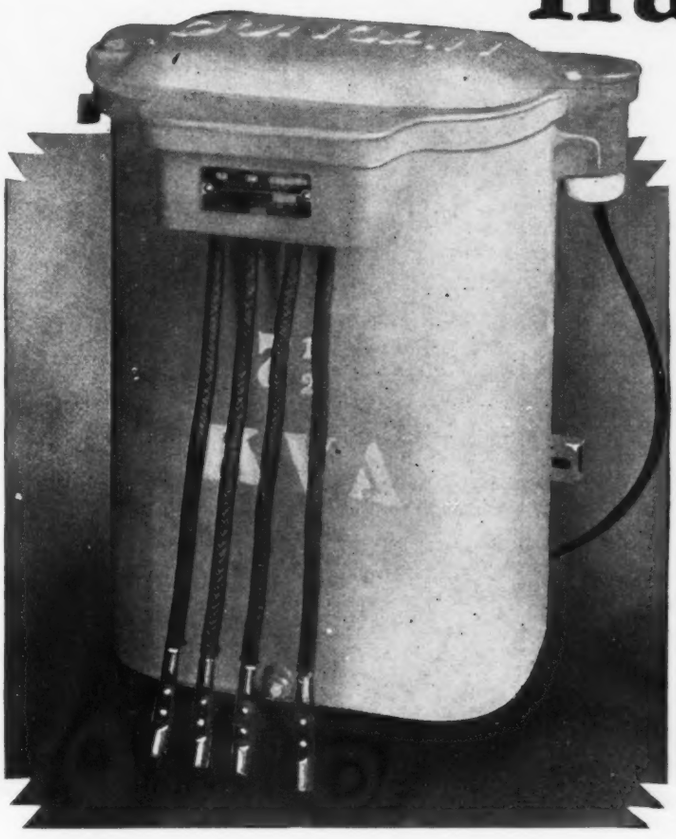
1331 Tyler Street, N. E. Minneapolis, Minn.

EM *Power Factor Improvement* CAPACITORS

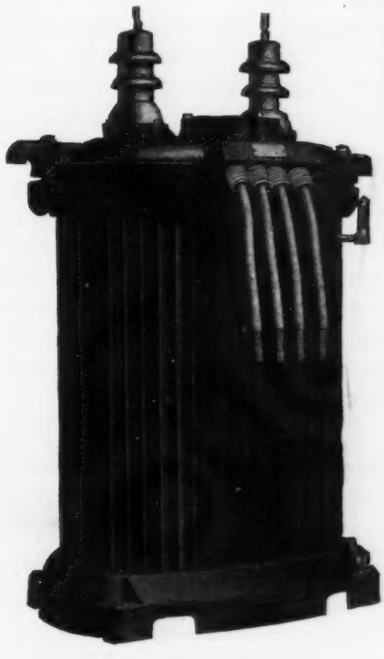
STATIC CONDENSERS FOR LINE POWER FACTOR CORRECTION

(4069)

Duncan Type B Distribution Transformers



For more than fourteen years Duncan Type B Transformers have been giving service of unsurpassed efficiency throughout the central station field. This is the sound basis of their steadily increasing popularity.

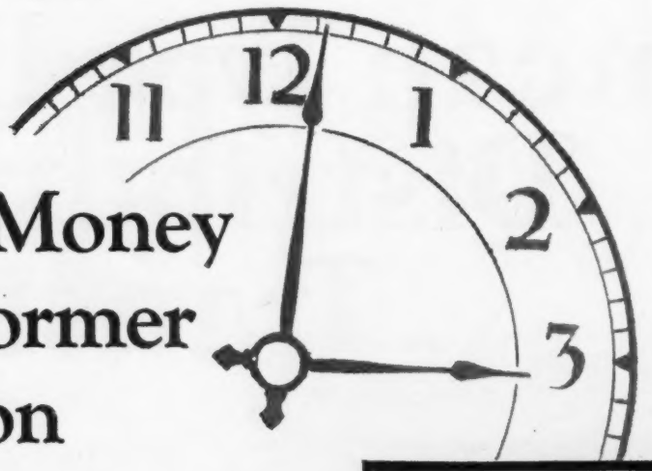


The Duncan Electric Manufacturing Company is prepared at all times to make prompt delivery on orders for distribution type transformers. Painstaking care both in manufacture and delivery will assure your satisfaction.

DUNCAN ELECTRIC MANUFACTURING COMPANY, LAFAYETTE, IND.

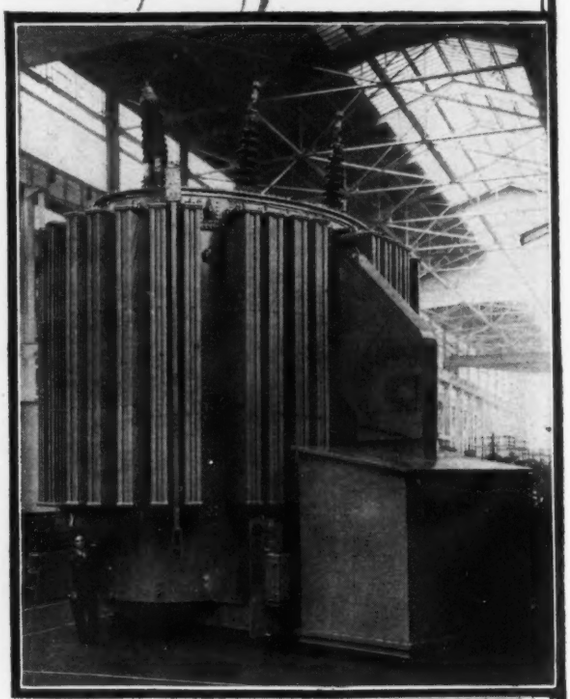
DUNCAN ELECTRIC MANUFACTURING CO. LAFAYETTE, IND.

DUNCAN *Transformers*



Time *is* Money *in* Transformer Installation

A 33,333 kv-a. Transformer.



WHEN Westinghouse "Blazed the Trail" with the record breaking 33,333 kv-a., 220,000-volt power transformers for the Plymouth Meeting Substation of the Conowingo development, quick installation was obtained by unique methods.

Each of the huge transformers was shipped in a special tank, mounted on a drop-frame freight car built for this shipment. The tank was as large as railroad clearances would permit. The transformer core and coils, after being thoroughly dried out, were put into the shipping tank which was mounted on the car and filled with oil.

When the car arrived at the Plymouth Meeting Substation, all that was necessary was to lift the transformer from the shipping tank and place it in its own oil-filled tank. The transformers, therefore, required no drying out. The installation was thus accomplished in a minimum of time and with maximum economy.

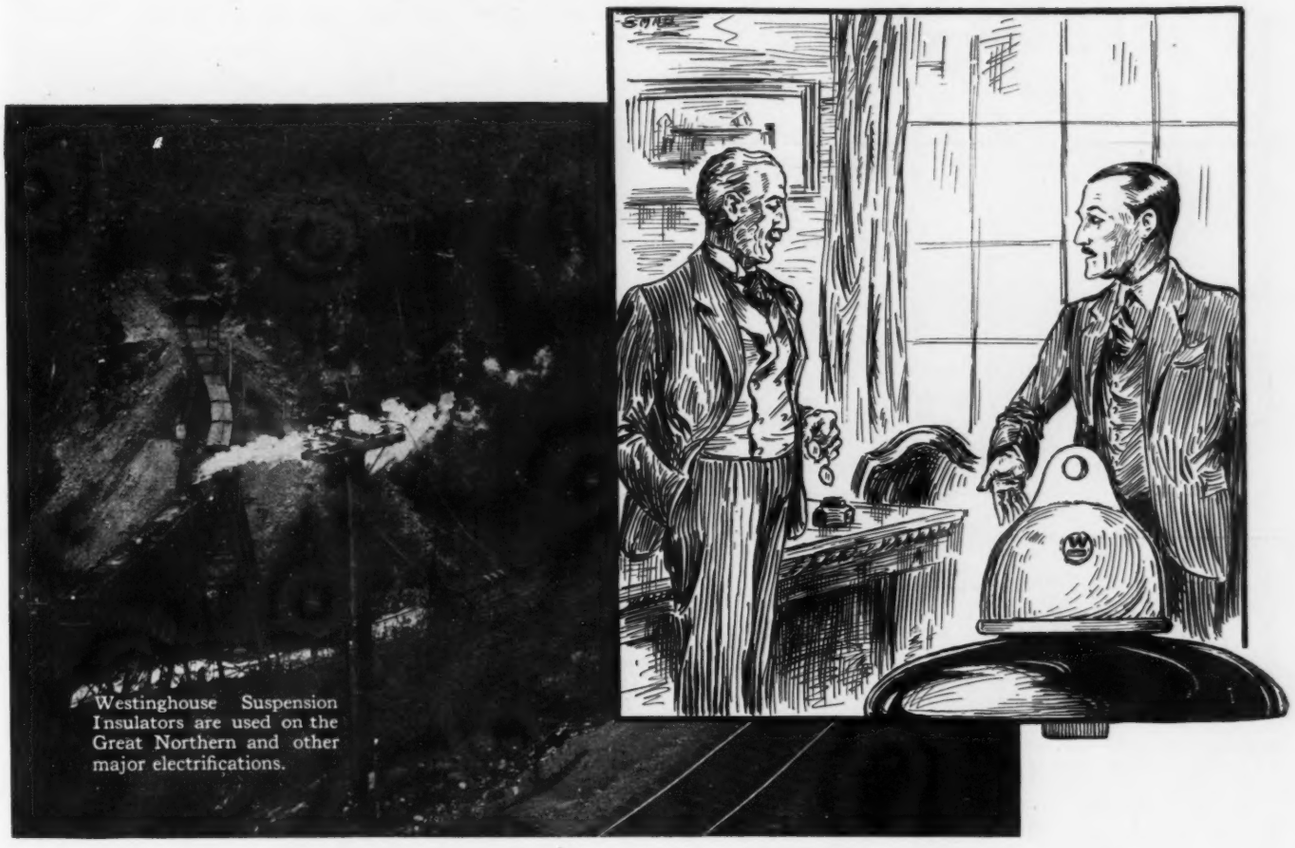
Westinghouse transformers are designed for rapid installation, long life and high operating efficiency. For complete information on Westinghouse Power Transformers write to the nearest Westinghouse District Office.

Westinghouse Electric & Manufacturing Company
East Pittsburgh Pennsylvania
Sales Offices in all Principal Cities of the United States and Foreign Countries

W WESTINGHOUSE ELECTRIC

Westinghouse

T 30033



Westinghouse Suspension Insulators are used on the Great Northern and other major electrifications.

"We recommend Westinghouse Insulators for this electrification"

Porcelain
you can install *– and forget*

—because science—not tradition—governs the making of all Westinghouse porcelain and insulators.

—precision processes, at every stage, are the rule.

—never is anything taken for granted.

—even slight variations in materials are compensated for.

First the design—then the materials—then the method—and then, a vigilance that permits no compromise.

MANY leading consulting engineers recommend Westinghouse insulators for important railroad electrifications.

This display of confidence in Westinghouse insulators is a logical result of past performance.

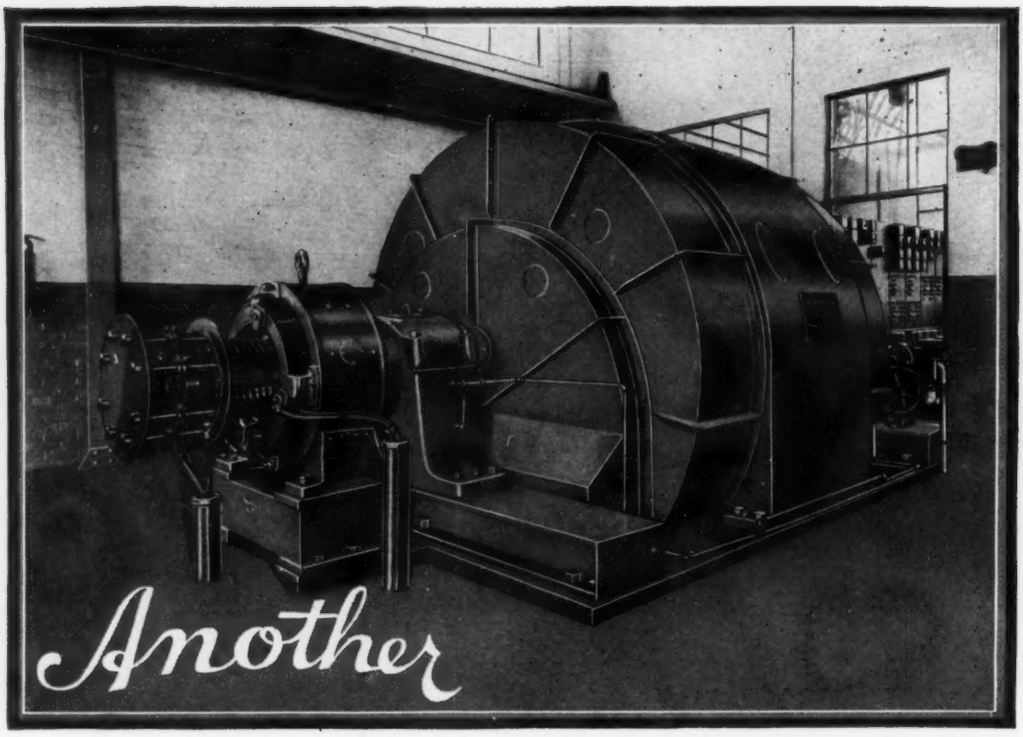
Westinghouse suspension type insulator No. 601, for example, has proved very satisfactory for heavy duty railroad service, on the Virginian, N. & W., N.Y.N.H. & H., Pennsylvania, and other electrified roads. It has rated ultimate strength of 11,500 pounds. Numerous installations testify to its ability to live up to expectations.

Behind it are years of experience in supplying electrical porcelain, up-to-date insulator plants and modern manufacturing methods.

Westinghouse Electric & Manufacturing Company
Derry (Pa.) Works Emeryville (Calif.) Works
Sales Offices in All Principal Cities of the United States and Foreign Countries T 30006

Westinghouse

T 30006



SYNCHRONOUS CONDENSER
for Connecticut Light and Power

THE Connecticut Light and Power Company again chose Westinghouse when another 10,000 kv-a. synchronous condenser was needed to control the voltage from the Meridan distribution substation.

That a Westinghouse unit should be selected to supply the reactive kv-a. required was only natural. It was the direct result of the unfailing performance of Westinghouse synchronous condensers--performance that assures uninterrupted operation year after year.

Westinghouse manufactures a standard line of synchronous condensers, ranging in capacity from 100 to 30,000 kv-a. Special condensers are built for any higher ratings desired.

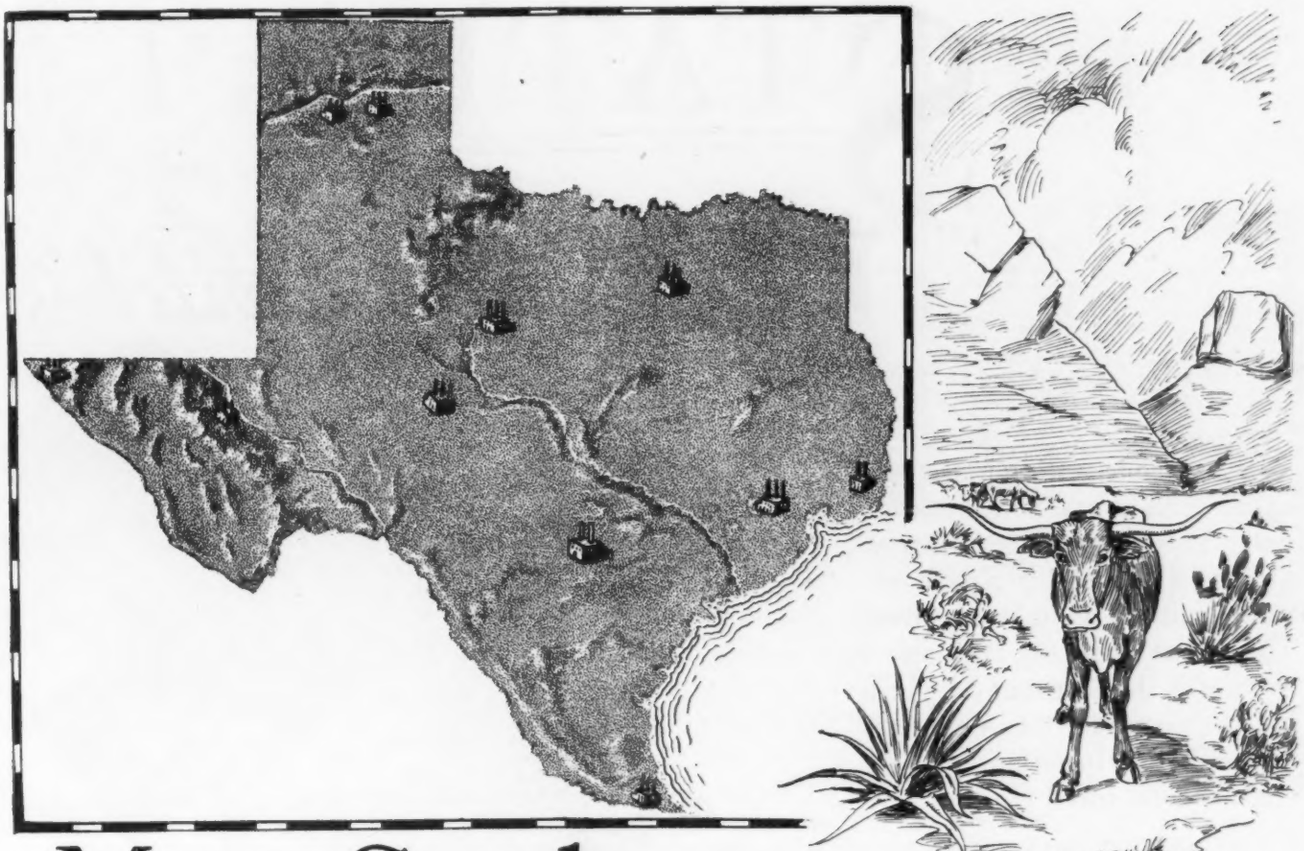
The rotors and frames are fabricated from structural steel with the electric arc, the modern and permanent form of construction. Special features of design make the losses of Westinghouse condensers low over their entire operating range. Low losses, of course, permit greater power output of the generating stations with resultant higher operating efficiency and economy.

Leaflet 20369, which fully describes Westinghouse synchronous condensers, can be obtained from the nearest Westinghouse district office

Westinghouse Electric & Manufacturing Company
East Pittsburgh Pennsylvania
Sales Offices in All Principal Cities of the United States and Foreign Countries

Westinghouse

T 30045



More Condensers *for* Texas

POWER companies in Texas have been installing Westinghouse surface condensers over a period of many years and in 1926 forty units totalling 641,600 square feet were in service. Then, in 1927, eleven of the old customers came back for additional Westinghouse condensers totalling 216,100 square feet.

Repeat orders of such magnitude can indicate only one thing--satisfactory and efficient operating performance.

Features of the Westinghouse Radial Flow Surface Condenser are effective distribution of steam, low frictional resistance to the flow of steam, efficient air removal, short vapor travel to the point of condensation, and condensate temperature the same as that of the steam at the turbine exhaust.

Westinghouse engineers will co-operate gladly in solving your condenser problems. Consult our nearest office.

Equipment for Power Plants includes—

Air Ejectors	Heat Exchangers	Stokers
Feed Water Heaters	Jet and Barometric Condensers	Surface Condensers and Auxiliaries
Generators	Reduction Gears	Turbines
Generator Air Coolers		

Westinghouse Electric & Manufacturing Company
South Philadelphia Works Philadelphia, Pa.
Sales Offices in all Principal Cities of the United States and Foreign Countries

Westinghouse

T 30041

STATES

RELAY *Test Switches*

Panel space is getting more valuable with every new installation. This illustration indicates the small space this new compact, simple switch requires. This is one of its big features—another is the fact that only one hole is required for mounting the switch. Installation costs are therefore small.

All test connections can be made on front of panel—no need of going behind the board during test.

Furnished for 1, 1½, and 2-in. and steel panels.

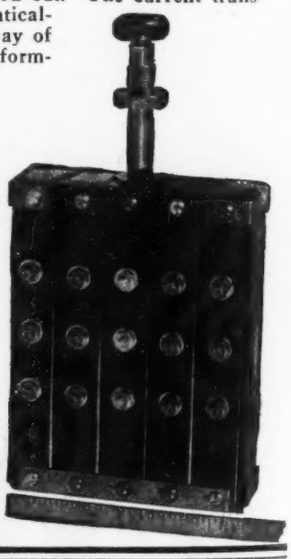
Full Size View

Pat. Pending

Rugged—simple to operate—easy to seal—and best of all—occupies little space on panel.

OPERATION SIMPLE. Take for instance the current unit. The rod is pushed in during the normal "Run" position—and sealed if desired. For relay testing or meter testing simply pull the rod out. The current transformer is automatically shorted—no way of opening the transformer circuit. The rod has a travel of 1⅛ in.

Furnished either as potential or current units including necessary binding posts for test connections on front of panel.



This shows how the units may be grouped and operated by one knob—only one hole thru panel.

Systematic Meter Testing

THE STATES COMPANY

Pays Handsomely

43 New Park Ave. Hartford, Conn.

Products

THE STATES COMPANY

Announces a New Idea in TEST BLOCKS

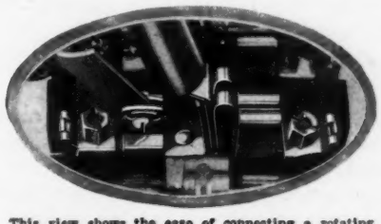
Pat. Pending

Note compactness and neat appearance of block—made in several different pole arrangements.

No other Switch-type Test Block Has These Advantages!

Pictures are poor substitutes for the real thing—we would like to have you take one of these new STATES Type SJ (Shunted Jack) Test Blocks in your own hands—lift off the cover—test the SNAP of the switch contacts—note the ease of opening and closing the switch because of the unique design of the switch knob—without danger of touching a live part—study the ingenious new idea in the (Shunted Jack) principle—please note how the jack goes in at *right angles* to the block—simplicity and quickness itself—here is a positive acting—ruggedly constructed test block. The same block can be used as either a front or back connected block. Extra notched sub-bases are supplied for front connections.

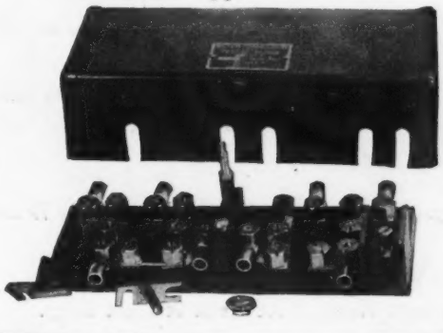
Sample blocks will be cheerfully sent on approval to all authorized persons making the request for the block on their Company's letterhead.



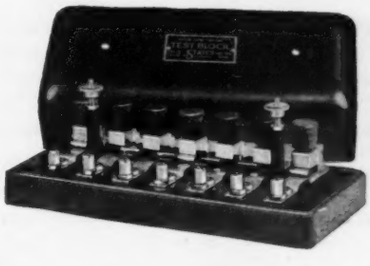
This view shows the ease of connecting a rotating standard or indicating instrument by means of a plug inserted at rightangles to block.

The States Line of Test Block also includes:

Type "T"



States Type T test blocks are fully described in Catalog No. 1, section 9.



States Heavy-Current blocks are supplied in capacities from 75 amperes up to 400 amperes.

Systematic Meter Testing
THE STATES COMPANY
Pays Handsomely

43 New Park Ave. Hartford, Conn.

Additional K-W hours without increase of fixed charges

Read how this has been done: *

EUROPEAN SUCCESS

European practice is well ahead of American practice in meeting the problem of filling up the valleys in the load curve without adding to plant investment. This has been achieved largely through water heating and to some extent with house heating.

Taking up the European progress on this subject, we find it has been due largely to two-rate and three-rate meters. In Europe there is no fear of a night rate on the ground of discrimination. European customers understand the peak problems of their utilities and are educated to the difference between cheap night current and costly peak current. The intelligence of the American customer is such that the same education can be accomplished here.

The wash-day problem and the abnormal bath-day problem in Europe is not as serious as in this country and yet it has been found feasible in some European cities to adopt small kitchen heaters to supplement the basement storage, as we suggest herein.

The average cost in Europe is about $2.00 per month for heating water and based on the relative earning power of the American customer as compared to the European, the average family can easily afford to spend $5.00 to $8.00 per month for water heating. Water can not be heated automatically for less in the North except with partial or intermittent service.

Turning again to European successes in obtaining hot water load, we find the use of equipment similar to our Committee tests. The average size of tank we find to be 25 gallons in Europe, whereas the increased requirements of the American family call for an average of double the size of the tank but without increasing wattage. The customary wattage in Europe is 1000 with the well insulated storage tanks in general use in Strassbourg and cities of Switzerland. These insulated tanks, with insulation from 2½ to 5 inches thick, depending on the make and type of "boiler," successfully heat water with 1000 to 1500 watts. In practically all cases night current heats sufficient water to take care of the average family during the day.

The possibilities of large capacities, of several hundred gallons, using off-peak current entirely, have been fully developed in some old-world cities. The value of this load is obvious, even though it uses extra transformer and service equipment as contrasted to domestic off-peak heating.

As to the effect on load factor, until lately in Paris it was 22 per cent. It is now 70 per cent in certain Swiss cities. Water heating offers particular opportunity to improve load factor.

* *Excerpts from the Annual Report, Committee on Electric Water Heating, Empire State Gas and Electric Association.*

TWO-RATE METERS

It is obvious that great possibilities are opened up through transferring the use of many appliances to off-peak periods. To gain this objective is a justification for the use of two-rate meters rather than placing time-switches on individual appliances; or attempting to average the night-time and day-time use in one average rate structure.

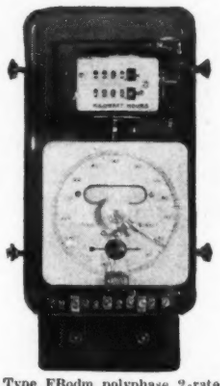
The additional revenue from domestic hot water will pay for the company's investment in two-rate meter and contact clock in six months. There is no good reason for charging the customer for two-rate metering apparatus, although a minimum charge of $3.00 or $4.00 is advisable.

Europe has already pointed the way. In one city over there, we find 80,000 meters and 20,000 of them with time-clock attachments. One-quarter of their customers are equipped by the company to use night rates.

LANDIS & GYR

2-Rate Meters

are used to handle the metering of this problem in a simple way and without complicating present metering methods.



Type FBodm polyphase 2-rate meter with maximum demand indicator.

Data, information and suggestions on two-rate metering gladly furnished on request.

The Largest Line of Electricity Meters in the World

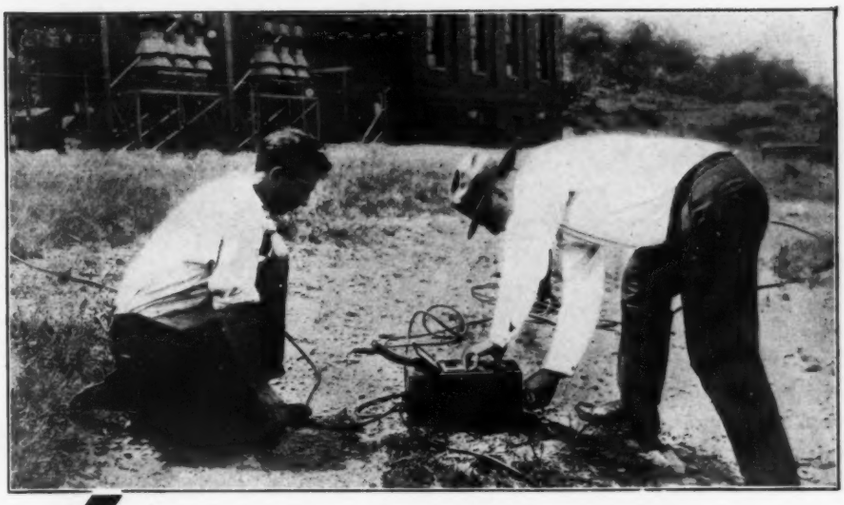
LANDIS & GYR, INC.

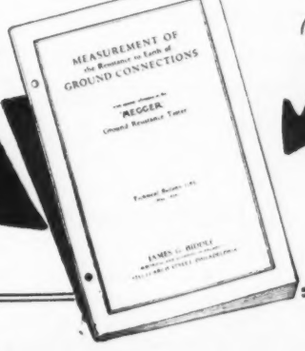
Herbert Nehls, Vice Pres. & Gen. Mgr.

104 Fifth Ave., New York, N. Y.

ALTHO the "Megger" Ground Tester is a *new* instrument—it is in use already by a large number of engineers. The following names are typical of companies who have placed orders:

Arkansas Power & Light Co., Pine Bluff, Ark.
Binghamton Light, Heat & Power Co., Binghamton, N. Y.
Carolina Pwr. & Lt. Co., Raleigh, N. C.
Central Hudson Gas & Electric Co., Poughkeepsie, N. Y.
Cleveland Electric Illuminating Co. Cleveland, Ohio
Commonwealth Edison Co., Chicago, Ill.
Consolidated Gas Elec. Lt. & Pwr. Co. Baltimore, Md.
Consumers Power Co., Jackson, Mich.
Detroit Edison Co., Detroit, Mich.
Dixie Construction Co., Birmingham, Ala.
Duquesne Light Co., Pittsburgh, Pa.
General Electric Co., Schenectady, N. Y.
Georgia Power Co., Atlanta, Ga.
Glen Alden Coal Co., Scranton, Pa.
Houston Lighting & Power Co., Houston, Texas
Illinois Bell Telephone Co., Chicago, Ill.
Illinois Central R.R. Co., Chicago, Ill.
Illinois Power & Light Co., Decatur, Ill.
Indiana Bell Telephone Co., Indianapolis, Ind.
Kansas City Power & Light Co., Kansas City, Mo.
Long Island R. R. Co., Jamaica, L. I.
Louisville & Nashville R. R., Louisville, Ky.
Luzerne County Gas & Electric Co., Kingston, Pa.
Metropolitan Edison Co., Reading, Pa.
Minnesota Power & Light Co., Duluth, Minn.
Nebraska Power Co., Omaha, Neb.
New Bedford Gas & Electric Co., New Bedford, Mass.
New England Power Co., Worcester, Mass.
New York Telephone Co., Bronx, N. Y.
Northern Ohio Power & Light Co., Akron, Ohio
Ohio Edison Co., Springfield, Ohio
Ohio Power Co., Canton, Ohio
Pennsylvania Water & Power Co., Holtwood, Pa.
Philadelphia Elec. Co., Philadelphia, Pa.
Phila. Suburban Gas & Electric Co., Norristown, Pa.
Public Service Co. of Northern Illinois, Chicago, Ill.
Public Service Electric & Gas Co., Irvington, N. J.
San Antonio Public Service Co., San Antonio, Texas
Seaboard Air Line R. R. Co., Savannah, Ga.
Sioux City Gas & Electric Co., Sioux City, Iowa
Southwestern Light & Power Co., Oklahoma City, Okla.
Southwestern Public Service Co., Amarillo, Texas
Staten Island Edison Co., St. George, S. I.
Syracuse Lighting Co., Syracuse, N. Y.
City of Tacoma, Tacoma, Wash.
Tennessee Electric Power Co., Chattanooga, Tenn.
Texas Utilities Co., Lubbock, Texas
City of Toledo, Toledo, Ohio
Union Gas & Electric Co., Cincinnati, O.
West Chester Lighting Co., Mt. Vernon, N. Y.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
Wheeling Electric Co., Wheeling, W.Va.
Wisconsin Michigan Power Co., Iron Mountain, Mich.
Wisconsin Public Service Co., Green Bay, Wis.
Wisconsin Public Service Co., Oshkosh, Wis.





Convincing evidence of satisfaction—with

The "MEGGER" Ground Tester

(From a Large Utility Company)

"Replying to your inquiry of June 20 regarding results secured with the "Megger" Ground Tester purchased from you some time ago, approximately five hundred ground tests have been made with this instrument in generating stations, sub-stations and on transmission towers of our system.

"In using your equipment on this work and also in checking known resistances we are well pleased with the consistent, accurate and rapid results obtained.

"In some of the more difficult conditions where satisfactory results have previously been hard to obtain we have had no trouble in getting the answer with your outfit."

Name and full particulars on request.

Many prominent Utility Companies are abolishing complicated methods formerly used for testing ground connections, and are finding greater accuracy and speed with the "Megger" Ground Tester.

The new Technical Bulletin at the left contains authoritative instructions for simple, fast and accurate ground testing. Sent free to responsible officials and engineers. Ask for Bulletin 1185-W.

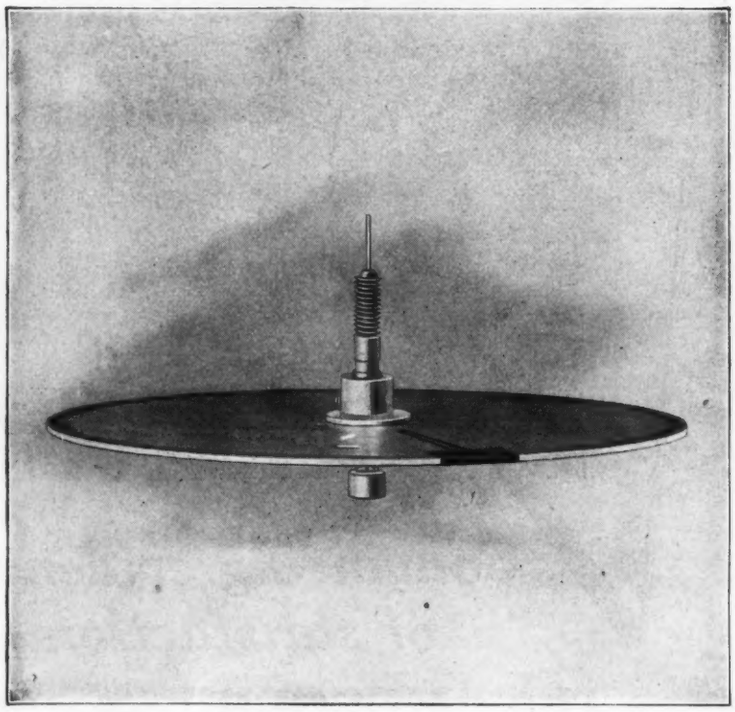
James G. Biddle

Electrical Instruments

1211-13 Arch St., Philadelphia, Pa.

"MEGGER"

TRADE MARK REGISTERED U.S. PAT. OFF.



Moving element Sangamo Type HC Meter, shows marking for stroboscopic testing.

In the *new*

SANGAMO TYPE HC METER

The disk is thicker . . . but the moving system no heavier

BY using duralumin for the hub and staff, the disk of the HC Meter has been made thicker than in the Type H and the torque maintained the same, without increasing the weight of the entire moving system (15½ grams). The torque in the HC Meter is 48 mm-g and the ratio of torque to weight 3.1.

The new Sangamo Type HC Meter has been standardized and modernized in all respects. The load curve is simply described... straight line accuracy up to 300 per cent. Temperature-compensated means accuracy at all power-factors, from 20 deg. to 120 deg. Fahrenheit. Voltage and frequency variations errors are negligible.

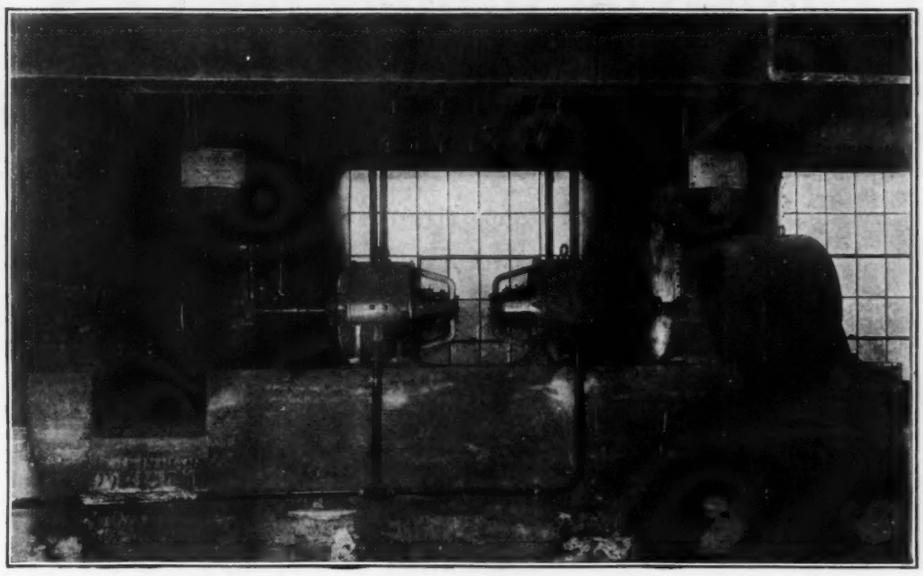
Mechanical changes provide a reinforced metal cover and permanent magnets accurately located and positively locked in position. The weight of the HC moving element and the torque are the same as in the Type H. The speed has been reduced and the direction of rotation reversed. In short the HC Meter has been brought up to date in every detail.

The HC Meter is fully described in an addenda to Bulletin 67, which will be sent on request.

SANGAMO ELECTRIC COMPANY . . . . SPRINGFIELD, ILLINOIS

ANOTHER ONE OF THE 57 ELECTRICAL MANUFACTURERS THAT USES SKF BEARINGS

Reliance Electric & Engineering Co.



Nothing is apt to cost so much as a bearing that cost so little

You men who plan, build, use or pay for machines of any kind, remember this: It costs more to replace a poor bearing than to buy the best one that SKF ever produced. AND SKF ANTI-FRICTION BEARINGS ARE THE HIGHEST PRICED IN THE WORLD.

Seven Reasons why Reliance and SKF Both Endorse Ball Bearings for Motors

FOR more than ten years the Reliance Electric & Engineering Co. has been using SKF Ball Bearings in motors of its manufacture. Two are used on each of the 35 H.P. D.C. motors shown, operating at 600-1600 R.P.M. With the satisfaction of the ultimate user placed above price, SKF Ball Bearings bring these seven real advantages according to Reliance—which SKF endorses:—

1—Lubrication is a once-a-year job.
2—Costly breakdowns due to oil-soaked windings are ended.
3—Bearing failures are reduced.
4—Air gaps remain uniform throughout the life of the motor.
5—There is no chance of the rotor rubbing the stator due to bearing wear.
6—Where cleanliness is essential you cut out the muss and damage from dripping oil.
7—Motors may be mounted at any angle without changing end brackets.

SKF INDUSTRIES, INCORPORATED
40 East 34th Street, New York, N. Y.

2111

SKF
Puts the Right Bearing in the Right Place

SKF

THE HIGHEST PRICED BEARINGS IN THE WORLD

OUTDOOR SWITCHING EQUIPMENT

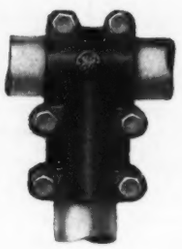
Clamp-type fittings for I.P.S. tubing eliminate costly field work

90-degree angle connector

Installation is extremely simple and requires minimum time. By tightening the clamping bolts, a positive and permanent connection is effected.

There is no soldering, heating, or annealing as with shrink-fit and soldered fittings. These operations are costly and the result is undesirable for outdoor service.

G-E clamp-type fittings are inexpensive and are available for any application. They are mechanically strong. Maximum conductivity is assured by pressure contact. Their current-carrying capacity is equal to that of extra-heavy, iron-pipe-size copper tubing.

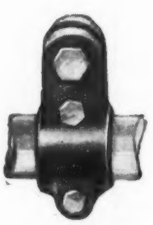


"T" connector

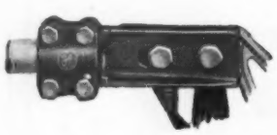
Extended guide clamp and "T" connector

Oil circuit breaker terminal

Straight connector



Bus hanger



Disconnecting switch terminal

Your purchase of G-E outdoor switching equipment is your assurance of a permanent source of renewal parts and the services of a nation-wide organization of specialists. For complete information on clamp-type fittings, ask the nearest G-E sales office for a copy of GEA-286B.

Wire and cable "T" connector

500-23

GENERAL ELECTRIC

GENERAL ELECTRIC COMPANY, SCHENECTADY, N. Y., SALES OFFICES IN PRINCIPAL CITIES

The J. G. White Engineering Corporation

DESIGNERS and CONSTRUCTORS
REPORTS and APPRAISALS

Dams
Irrigation Systems
Steam Power Stations
Hydro-Electric Stations
Sub-Stations
Transmission Lines
Pipe Lines
Oil Refineries
Industrial Plants
Warehouses
Water Works
Railroads
Wharves and Sea Walls
Bridges
Highways
Sewage Systems
Hotels
Apartments
Bank and Office Buildings
Industrial Housing

43 EXCHANGE PLACE

NEW YORK, N. Y.

Operating in South America as

THE ENGINEERS CORPORATION

which is owned and fully guaranteed by

THE J. G. WHITE ENGINEERING CORPORATION

Specializing in the Underwriting and Distribution of Securities of

PUBLIC UTILITY COMPANIES

The outlook for the future of the Public Utility Industry is for further expansion in order to enable it to meet the growing demands for service both for industrial and domestic purposes.

For a number of years we have been actively identified with financing of many important Electric Power and Light and Gas Companies and have made a close study of the securities in these industries. In this connection we offer the experience and facilities of our organization.

PYNCHON & CO.

111 Broadway New York

CHICAGO LONDON

WE EXTEND the facilities of our organization to those desiring information or reports on companies with which we are identified.

Electric Bond and Share Company

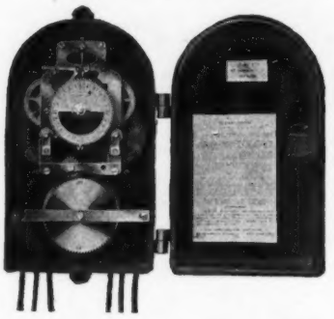
(*Incorporated in* 1905)

Paid-up Capital and Surplus, $135,000,000

Two Rector Street New York

HARTFORD

the time switch with 25 years of service behind it.



All types, all capacities

10 amp. to 200 amp.

The Hartford Time Switch embodies more real and lasting value than has ever before been offered in any automatic time switch, including the special marine type eight-day clock movement. Especially adapted for lighting and all power lines, two rate meter service, electric signs and display windows, etc.

There is a Hartford Time Switch in just the right type and capacity for every time switch purpose.

Bulletins, Prices and information on request.

HARTFORD TIME SWITCH CO.

A. HALL BERRY, General Sales Agent
71 Murray St., New York, N. Y.

Additional Issue

60,000 Shares

The American Superpower Corporation

(OF DELAWARE)

First Preferred Stock, $6 Series

(No Par Value)

Dividends payable quarterly January 1, April 1, July 1 and October 1. Redeemable as a whole or in part, at the option of the Corporation, at $110 a share and accumulated dividends.

Mr. L. K. Thorne, President of the Corporation, summarizes from his letter as follows:

Business — The American Superpower Corporation (organized under the laws of the State of Delaware, October 26th, 1923) holds for investment the common stocks of a number of successful and progressive companies in the electric light and power business. Its earnings consist primarily of dividends on these stocks. In addition, it has received fees in connection with the underwriting of offerings of additional stocks of certain of the companies in which it is interested, and has sold at substantial profits certain of its holdings.

Purpose of Issue — Proceeds from the sale of this Preferred Stock will be used for the acquisition of additional interests in certain electric light and power companies and for other corporate purposes.

Earnings — The statement of income for the twelve months ended August 31, 1928, shows a balance available for dividend payments of $5,346,133 which is **more than 2.8 times** the annual dividend requirements of the First Preferred Stock which will be outstanding upon the completion of this financing.

These earnings do not include the enhancement in market value during the period of the present holdings of the Corporation, nor do they include stock dividends received, nor the income to be derived from the investment of the proceeds of this issue.

Assets — The Corporation has no funded debt. Its net assets (at current market prices at the close of business September 22) after giving effect to this financing exceed $118,000,000. This amount is equal to more than $380 for each of the 310,000 shares of First Preferred Stock to be presently outstanding.

All legal matters in connection with this issue of stock will be passed upon by Messrs. Winthrop, Stimson, Putnam & Roberts of New York. The accounts of the Corporation are audited semi-annually by Messrs. R. G. Rankin & Co., Public Accountants.

This Stock is offered when, as and if issued and received by us and subject to the approval of counsel

Price $99½ a share and accrued dividends, to yield over 6%

Bonbright & Company

Incorporated

25 Nassau Street New York

Chicago Boston Philadelphia Detroit St. Louis San Francisco

The information contained in this advertisement has been obtained from official sources and is accepted by us as accurate

INDUSTRY HAS ADOPTED MONEL METAL
THE SATURDAY EVENING POST
PROPERTIES AND USES OF MONEL METAL
Yum-Yum! There's more Zip in Beverages served from a Monel Metal topped cooler
Liquid Carbonic Cooler
MONEL METAL
MONEL METAL
A PRODUCT OF THE INTERNATIONAL NICKEL CO. INC.
The Literary Digest
THE SATURDAY EVENING POST

This Monel Metal advertisement, featuring a famous bottle cooler, appears in the May 5th issue of The Saturday Evening Post and the May 19th issue of The Literary Digest.

4,500,000 CIRCULATION

Monel Metal advertising reaches the 3,000,000 readers of The Saturday Evening Post and the 1,500,000 readers of The Literary Digest. Nearly five million people are regularly being told about Monel Metal.

Selling the Millions about Monel Metal's properties

THE success of nationally advertised products is traceable to the wide-spread consciousness of those products. When millions of buyers — in all parts of the country — KNOW, through advertising, the name and advantages of a particular product, that knowledge results in larger sales.

In the case of Monel Metal, larger sales can only come through increased sales of products employing Monel Metal. Therefore, all Monel Metal advertising is planned to increase the sales of manufacturers whose products embody Monel Metal. The natural outcome is easier selling for everyone connected with such products. Salesmen, dealers and refrigerator manufacturers, themselves, all feel the influence of Monel Metal national advertising — advertising that is constantly telling millions of people that a Monel Metal trimmed product is a quality product.

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Monel Metal is a technically controlled Nickel-Copper alloy of high Nickel content. It is mined, smelted, refined, rolled and marketed solely by The International Nickel Company. The name "Monel Metal" is a registered trade mark.

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NON-METALLIC
ELECTRICAL
HEATING ELEMENT

GLOBAR—the Non-Metallic Heating Element—gives you increased furnace production because it makes possible the certainty of continuous operation.

There is no loss in operating time in changing an element—Globar is so easily, quickly replaced—without shutting down—without any tearing down—that there is no interruption of production—

Besides Globar insures uniform, easily controlled temperatures up to 2700° F.

Globar is a Carborundum Product
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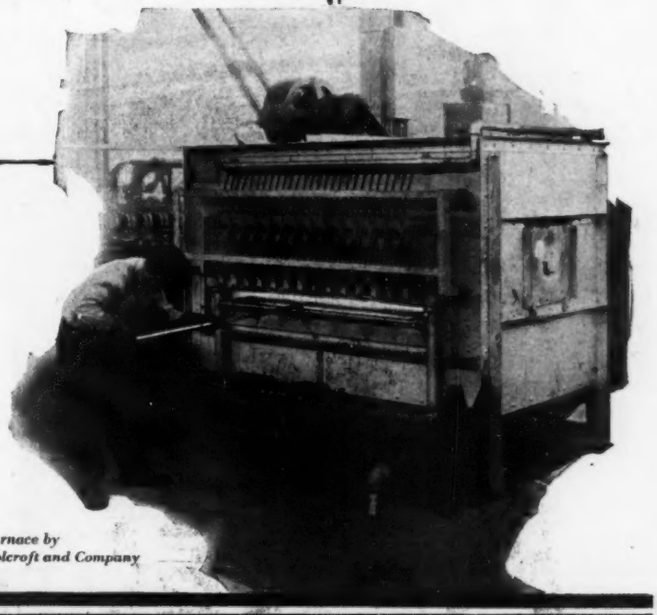
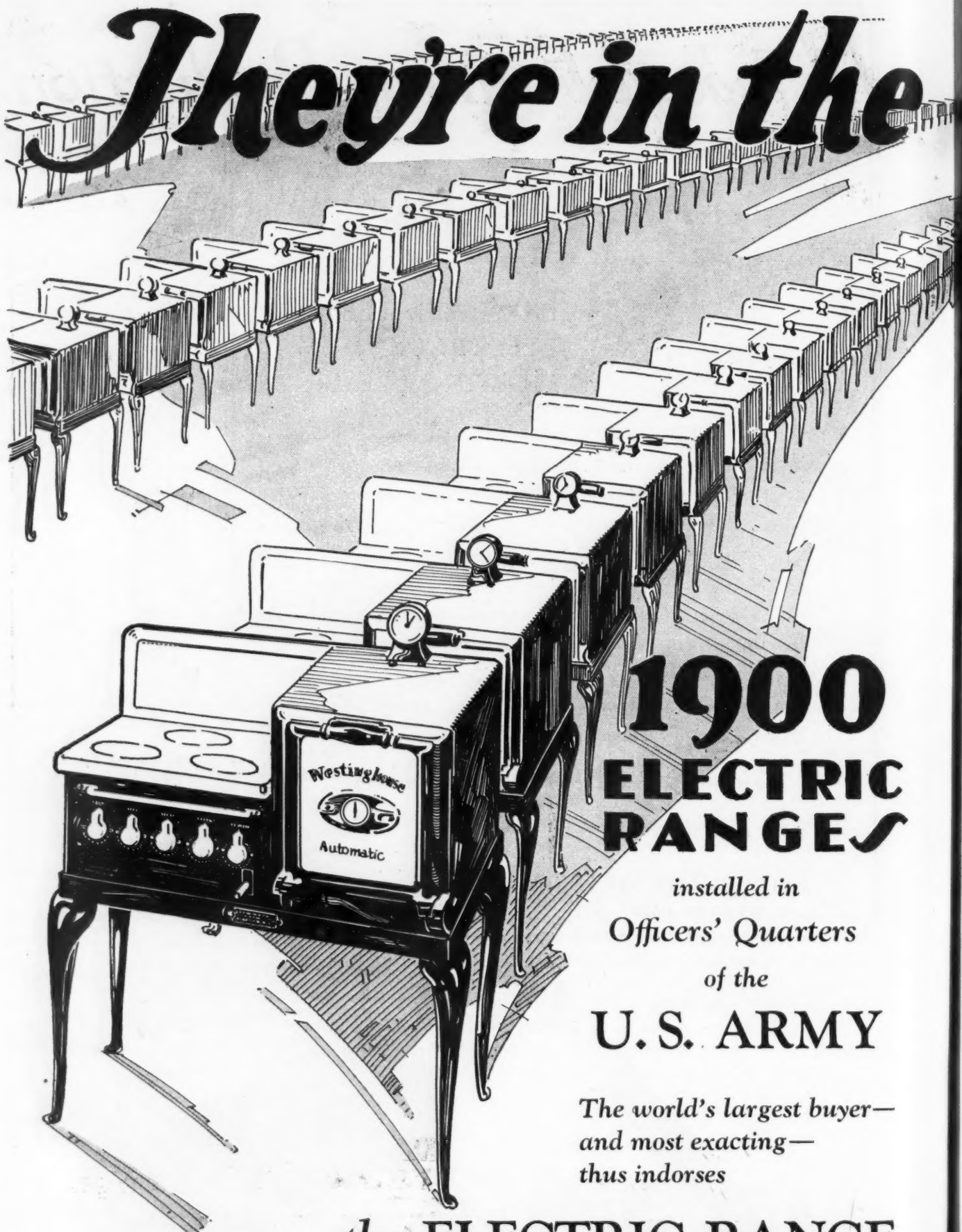


Furnace by Holcroft and Company

They're in the



1900 ELECTRIC RANGES

installed in

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The world's largest buyer—
and most exacting—
thus indorses

the ELECTRIC RANGE

ARMY now!

To Central Station Executives

NOTHING is *sold* to Uncle Sam.

He buys.

No other electrical buyer more thoroughly analyzes his purchases.

Research, laboratory test, specifications —every known safeguard protects or instigates his purchases.

This announcement of his purchase of 1900 electric ranges is published by the Driver-Harris Company for two reasons:

(1st)

To assure the utilities that have adopted the electric range that development expended by range manufacturers has been right.

(2nd)

To assure range manufacturers that the early predictions of Driver-Harris as to eventual complete acceptance of the electric range were not gestures.

"Nichrome" was the first resistance wire offered to range manufacturers.

DRIVER-HARRIS COMPANY
HARRISON, NEW JERSEY

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Through a generation of research and development this company has built solidly until today it operates the largest plant in the world devoted to alloy products.

By operating its own melting furnaces—by rolling mill ownership—by controlled check on every step of fabrication

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The Ideal Resistance **Nichrome IV** *for Electric Ranges*

High Temperature Service

Sepco

FEATURED BY UTILITIES EVERYWHERE

because—

It insures a low-demand load over the entire twenty-four hours.

It improves the load factor, and is so constructed that only a small portion of its connected load is in circuit most of the time. NO OTHER WATER HEATER HAS THIS FEATURE.

It has no moving parts, nothing to get out of order. The heating units are safe in any kind of water or air. The Sepco unit can be renewed without draining the tank or breaking a connection.

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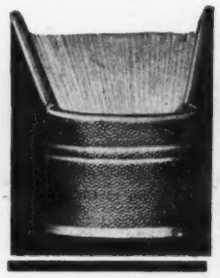

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MAIL THE COUPON

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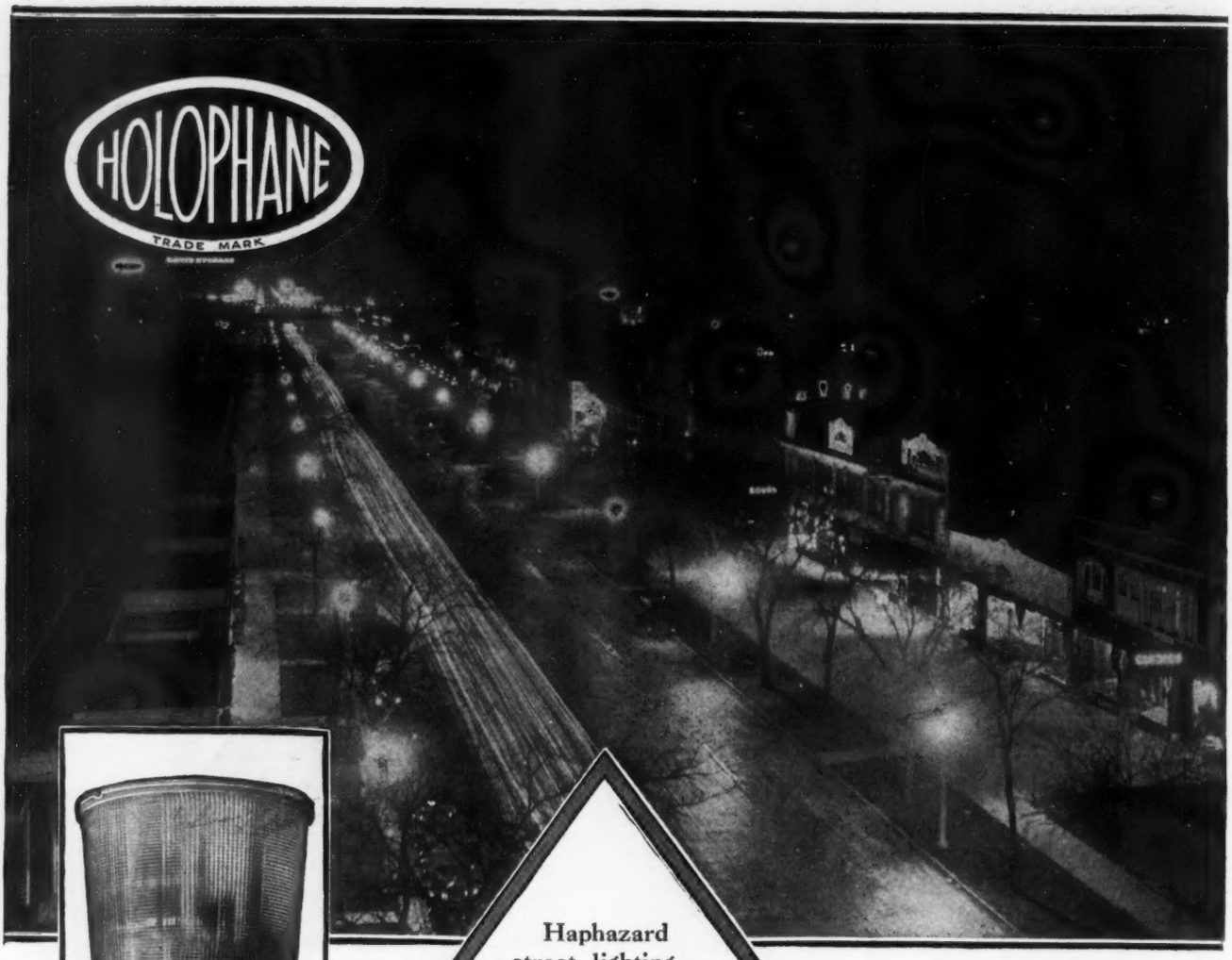

The illustration at the left shows the Holophane BI-LUX refractor which is one of the many different types in the Holophane line. This refractor is a Holophane specific for increasing the effectiveness and efficiency of ornamental street lighting.

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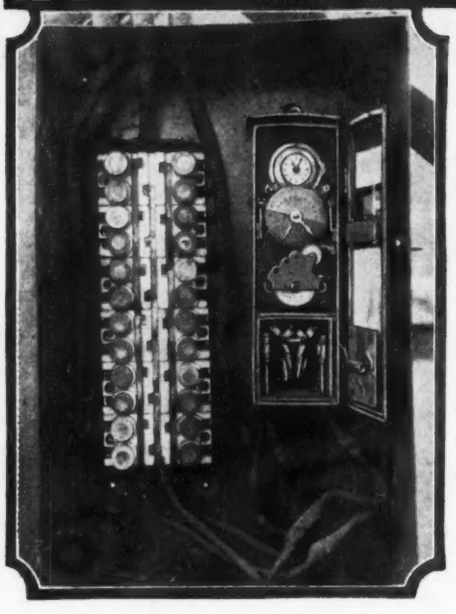

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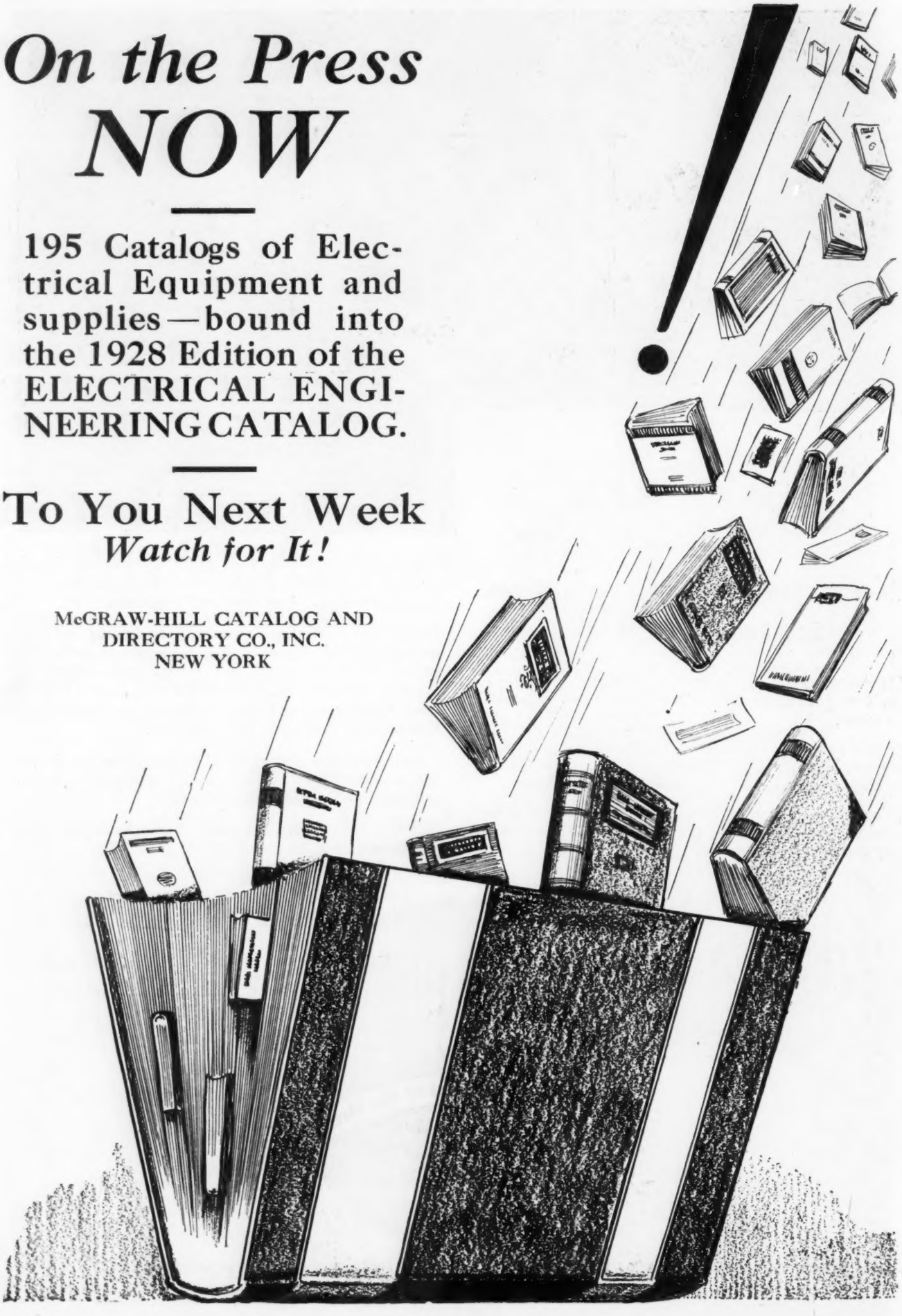

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POSITIONS WANTED

DISTRICT representative or general foreman; ten years' diversified electric utility experience as utility man, mechanic, foreman and general foreman; operation, maintenance and construction; also commercial high school education; best references; hard worker; now employed; age 30. PW-720, Electrical World, Tenth Ave. at 36th St., New York.

ELECTRICAL mechanic, electro-technical training and practice, 30 years' experience machinist, instrument maker, inspector, etc., especially telephone and signals, wants position in office or shop. PW-716, Electrical World, Tenth Ave. at 36th St., New York.

POSITIONS WANTED

ELECTRICAL engineer, single, 29, two years G.E. test; two years field service engineer with General Electric, Pittsburgh district office; one year assistant to plant manager; familiar with automatic substations, steel mill and mine equipment and control; desires permanent position with future. PW-744, Electrical World, Tenth Ave. at 36th St., New York.

ELECTRICAL engineer and supervisor, 34, experience with utilities including overhead light and power distribution; did considerable Diesel engine and refrigeration work, desires connection in responsible position, such as assistant manager or electrical superintendent; excellent references; location immaterial. PW-735, Electrical World, Tenth Ave. at 36th St., New York.

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TEST ENGINEER
Position calls for a technical graduate familiar with distribution and transmission systems. Required to locate faults on power cables, make acceptance and installation tests on cable and be familiar with test methods employed in this work. Must be able to handle high voltage test equipment including Kenetron test set at 150 kv. rating.
Position open is with light and power company in Greater N. Y.
In reply give full information including age, education, and previous experience.
P-738, Electrical World, Tenth Ave. at 36th St., New York City

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MOTOR GENERATOR SETS

1—250 kw., 250 v., G.E. Generator, 3 ph., 60 cy., 2200 v. synchronous motor.
200 kw., 600 r.p.m., 250 v. Gen., 3 ph., 60 cy., 440/2200-v. synchronous motor.
150 kw., 600 r.p.m., 250 v. Gen., 3 ph., 60 cy., 220/440 v. G.E. synchronous motor.
1—125 kw., 250 v. Westinghouse synchronous generator motor set.
1—100 kw., 125 v., D.C., 220/440 A.C., G.E synchronous motor generator set.
100 kw., 250 v. Gen., 900 r.p.m., 2200 synchronous motor.
1—75 kw., 250 v. Generator, 3 ph., 60 cy., 2200 v. synchronous motor.
60 kw., 125 v., C. W., 3 ph., 60 cy., 220/440 v. motor.
1—50 kw., 250 v. Westinghouse, 3 ph., 60 cy., 220/440 v.
1—37½ kw., 900 rev., 110 v., D.C., on same ba e with 60-hp. Lincoln 220 v., sq. cage motor.
10-20-25-40 kw., 125 v. Exciter Sets.
10-20-30 kw. Balancer Sets.
3-5 kw. Battery Charging Sets.

TRANSFORMERS

4—150 kw., 4150 v., 120/240 Pittsburgh Oil Cooled Transformers.
15—5 kw. 30 kw., 3 ph. Pole Type, 2200/1100 440/220/110 G.E.

A. C. GENERATORS

No.	Kw.	Rpm.	Volts	Ph.	Type
1	400	600	2200	3	GE "B"
1	300	450	2300	3	G.E.P.
1	250	600	440	3	Westg.
2	125	900	2300	3	Cr.-Wh.
2	100	900	230/2300	3	G.E.
1	75	600	220	3	Westg.
1	75	900	2300	3	G.E.
1	50	1200	220-440	3	G.E.
1	50	1200	2300	3	G.E.
1	30	1200	220-2200	3	G.E.

MOTORS—3 PHASE, 60 CYCLE

Hp.	Rpm.	Volts	Type
1 500	600	2200/4150	G.E. syn.
1 500	300	220/440	Westg. HF.
1 400	450	2200	G. E. synch.
1 300	300	2200	Westghse. synch.
1 250	600	220/440	Westg. syn.
1 250	600	440/2200	G. E. syn.
3 200	514	4150/2300	G. E. synch.
1 200	450	440/2200	G. E. sl. rg.
1 180	400	440/2300	Burke sl. rg. 3 brg.
1 150	900	2300	G. E. synch.
4 150	514	2200	Westghse. Slip Ring
1 150	1800	2200	Westg. sq.cg. motor
1 100	900	440/2200	G. E. sq. cg.
1 100	900	220/440/2200	West. sq. cg.
1 75	600	220	G. E. sq. cg.
1 75	720	220	Westg., C. W.
1 75	490	440	Allis-Chal. sl. rg.
1 75	900	2200	G. E. KT.
1 60	1200	220	G. E. sl. rg.
1 60	300	220/440/2300	Fair.-M. Syn.
1 50	600	2200	G.*E. MT. sl. rg.
1 50	900	2200	G. E. B.
1 50	1200	220/440	Wagner sl. rg.
1 40	1700	220/440	Westghse. sl. rg.
1 25	900	440/2200	Cr. Wheeler
1 25	1200	440	G. E. K.
1 25	900	220	West C. S.

(2 Phase Motors on request)

BRAND NEW MOTORS

No.	Hp.	Rpm.	Volts	Type	
5	7½	900	220-440	Gen. Electric	MT
1	10	1200	220-440	Gen. Electric	MT
2	15	1200	220-440	Gen. Electric	MT
1	15	1200	220-440	Gen. Electric	KT
4	25	600	220-440	Gen. Electric	KT
5	25	900	220-440	Gen. Electric	KT
1	30	900	220-440	Gen. Electric	KT
2	30	1200	220-440	Gen. Electric	KT
1	40	1200	220-440	Gen. Electric	MT
1	40	900	220-440	Gen. Electric	KT
1	40	1200	220-440	Gen. Electric	KT
1	60	720	220-440	Gen. Electric	KT

D.C. GENERATORS—250 VOLT

No.	Kw.	Rpm.	Type
1	200	600	G. E.
1	150	600	G. E.
1	125	600	Cr. Wheeler
1	100	720	G. E.
1	75	450	Diehl
1	50	600	Westghse.
1	30	1000	Westghse.

(Smaller sizes on request)

D. C. GENERATORS—125 VOLT

5, 10, 20, 22, 35, 50, 2-100 kw.
3—21 kw. 1250 r.p.m. Sprague

D. C. MOTORS—230 VOLTS

No.	Hp.	Rpm.	Type
1	250	550	G. E.
1	150	600	G. E.
1	150	1100	West. SK
1	125	550	Cr. Wheeler
1	100	625	Westg. type S
1	80	500	Allis-Chalmers
2	75	475	Westg. type S
1	50	560	Westghse SK
1	50	200	Diehl
1	50	650	Sprague
1	40	400	Diehl
1	40	1300	Diehl
1	35	200	Diehl
1	35	700	Cr. Wheeler
1	35	420	Diehl
1	20	665	Diehl
1	20	200	Diehl
1	20	900	Diehl
2	15	1050	Cr. Wheeler CM
8	10	375/750	Westg. S. var. sp.
	10	1350	Rochester

(Smaller sizes on request)

D. C. MOTORS—125 VOLT

1	125	575	G. E.
1	100	600	G. E.
1	80	600	G. E.
3	25	1200	Sprague
1	20	650	G. E.
1	15	775	SK Westghse.

POSITIONS WANTED

ELECTRICAL or design engineer, graduated E.E., 20 years on generating and substation design, interconnection of power systems, power factor correction, calculations on inductive co-ordination and transients, etc. PW-729, Electrical World, Tenth Ave. at 36th St., New York.

ELECTRICAL-MECHANICAL engineer, 1½ years pregraduation, general and operating experience, 2½ years G.E. test and engineering, 2 years station and substation design with large power company, desires permanent position with progressive manufacturer or utility. PW-747, Electrical World, Tenth Ave. at 36th St., New York.

ELECTRICIAN wishes position in Europe; 17 years' experience powerhouse, substation construction, industrial power, marine work and general construction; speaks French, German, Dutch, slight knowledge of Italian and Norwegian. PW-741, Electrical World, Tenth Ave. at 36th St., New York.

ENGINEERING executive—Graduate E. E., also General Electric test course; eight years' operating experience with a large public utility including testing, design, transmission, distribution, estimating, appraisals; qualifications include iniative coupled with seasoned judgment based on field experience both in engineering and public relations, and ability to follow through consistently and get results; understand general plan of public utility work and can co-operate with associates; references will be furnished from past and present employers and from outside business contacts; reason for change, no dissatisfaction with present management, but desire for larger responsibilities; will make a valuable assistant to a busy management. PW-709, Electrical World, 7 So. Dearborn St., Chicago, Ill.

GRADUATE engineer with 11 years' experience in mechanical and electrical power plant work, desires position with construction or operating company. PW-730, Electrical World, 7 So. Dearborn St., Chicago, Ill.

POSITIONS WANTED

GRADUATE E.E., age 35, American, with 10 years' practical experience, thoroughly trained in both maintenance and construction, past position in charge of both electrical and mechanical departments, employed but desire change in location. PW-745, Electrical World, 7 So. Dearborn St., Chicago, Ill.

GRADUATE electrical engineer with three years' experience in drafting and substation design, desires position with a public utility company; location immaterial. PW-742, Electrical World, Tenth Ave. at 36th St., New York.

TRANSMISSION engineer, age 30, ten years' experience surveys, design and construction transmission lines and transformer stations; four years transmission engineer with one company in charge of transmission line and substation location and construction; can furnish good references. PW-740, Electrical World, Tenth Ave. at 36th St., New York.

WANTED position by man experienced in cost accounting and general office work. PW-724, Electrical World, 7 South Dearborn St., Chicago, Ill.

WORKING manager utilities; capable billing, collecting, maintenance; good personality with public; good references. PW-706, Electrical World, Tenth Ave. at 36th St., New York.

WOULD like to become associated with a utility requiring the services of an experienced man in their appliance, commercial or security division, or in the promotional sales department of a manufacturer. PW-733, Electrical World, 7 South Dearborn St., Chicago, Ill.

SALESMEN WANTED

Power Sales Engineer

Opening for a man with technical education, experienced in power sales work, preferably one with oil field experience, who has also a knowledge of lighting problems and sales; kindly give complete outline of education and experience in first letter. Box 330, Amarillo, Texas.

SALESMAN AVAILABLE

SALESMAN—Technical school graduate with over six years' experience selling to electrical contractors and industrials; wide acquaintance in St. Louis territory. F. C. Douglas, 3537 Oregon Ave., St. Louis, Mo.

REPRESENTATIVE WANTED

A Sales Representative for Rochester Territory

Wanted. Must have motor sales experience and be thoroughly familiar with the application of small electric motors to motor driven machinery. This is an excellent opportunity for a man with motor sales ability to increase his earnings by connecting with an aggressive and rapidly growing concern. RW-746, Electrical World, 7 So. Dearborn St., Chicago, Ill.

BOOKS AND PERIODICALS

Books Wanted

One copy of "The Electrical Solicitors' Handbook" published by the National Electric Light Association, New York, 1911. Address replies: George Jaquet, 10 N. Fulton Street, Mt. Vernon, N. Y.

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Condensed course in electrical engineering; complete in one year; for men of character, ambition and limited time; theoretical principles and practical applications of electricity; mathematics, steam and gas engines, mechanical drawing, extensive shop work; construction, installation, testing; fireproof dormitories, dining hall, laboratories, shops; established in 1893; catalog on request. 239 Takoma Ave., Washington, D. C.

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HIGH GRADE STANDARD EQUIPMENT

Slip Ring Motors—3 Ph., 60 Cy.

Hp.	Volts	Make	Speed
400	2200-550	Whse.	450
225	220-440	G.E.	450
200	220-440	G.E.	600
150	220-440	G.E.	720
150	220-440-550	G.E.	900
125	2200	G.E.	1200
100	2200	G.E.	720
100	2200	G.E.	900
100	440-220	G.E.	720
100	440-220	G.E.	600
100	440-220	G.E.	900
75	220-440	G.E.	720
75	440-220	G.E.	900
75	550	G.E.	720
50	550	G.E.	514
50	220-440	G.E.	900
35	550	G.E.	900
35	220-440	G.E.	900
25	220-440	G.E.	1200
25	2200	G.E.	1200
20	550	Whse.	600

Synchronous Motors—3 Ph., 60 Cy.

Hp.	Volts	Make	Speed
240	2200-440	G.E.	720
135	2200-550	G.E.	900
110	2200	G.E.	900
80	2200-440-220	G.E.	1200

Direct Current Motors

Hp.	Volts	Speed	Make	Type
225	230	760	Westghse.	SK
130	115	1200	General Electric	RC
120	230	720	Westghse.	SK
65	230	675	G.E. (Series)	CO
60	230	1050	General Electric	RC
35	115	700	General Electric	DLC
30	115	1150	General Electric	RC

Direct Current Generators

200	250	850	Westghse.	SK
100	125	1200	General Electric	RC
100	250	625	Westghse.	SK
75	250	850	General Electric	CLB
65	125	800	Westghse.	SK
35	125	850	General Electric	DLC

Sq. Ca. Motors—3 Ph., 60 Cy.

150	440-220	G.E.	1200
100	550	G.E.	1800
100	220-440	G.E.	1800
100	220-440	G.E.	900
75	220-440	G.E.	900
75	220-440	G.E.	720
75	224-440	G.E.	1200
75	2200	Allis-Chal.	1200
50	220-440	G.E.	900
50	550	G.E.	900
40	220-440	G.E.	1200

Motor Generator Sets

1—220-kw., 250-v., 514-r.p.m., Westghse, D.C. with 300-kva., 2200-v., 3-ph., 60-cy., syn.
1—150-kw., 250-125-v., 3 wire, 720-r.p.m. Crocker-Wheeler Generator connected to 225-hp., 2200-440-v., 3-ph., 60-cy., syn. G. E. motor.
1—100-kw., 125-v., 1200-r.p.m., G. E. Type MPC.; D.C. Generator connected to 125-kva. G. E. Type ATI, 440-220-v., 3-ph., 60-cy., syn. motor.
1—50-kw., 125-v., 1150-r.p.m. G. E. Type RC, D.C. Generator connected to 75 hp. G. E. Type KT, 220-440-v., 3-ph., 60-cy. motor.
1—50-kw., 125-v., 1150-r.p.m. Westghse, S.K., D.C. Generator connected to 75 hp. Westghse. Type CS 2200-v., 3-ph., 60-cy. motor.

A. C. Generators

1—187-kva., 720-r.p.m., 2200-440-220-v., 3-ph., 60-cy., G. E. belted exciter.
1—112 ½-kva., 900-r.p.m., 2200-v., 3-ph., 60-cy. G.E. direct connected exciter.
1—100-kw., 900-r.p.m., 2200-v., 3-ph., 60-cy., G. E. belted exciter.
1—75-kw., 900-r.p.m., 480-240-v., 3-ph., 60-cy G. E., belted exciter.
1—75-kw., 1200-r.p.m., 2200-480-240-v., 3-ph. 60-cy., G. E. belted exciter.

STEPHEN HALL & CO., INC., 7th and Adams Sts., HOBOKEN, N. J.

200 H.P. LINCOLN SYNCHRONOUS MOTOR

220/440 volt, 900 r.p.m.

C & C PORTABLE ELECTRIC WELDER MOTOR GENERATOR SET

G. E. MOTOR BARGAINS

3 PH. 60 CY. 220 VOLT

Qu.	Hp.	Type	Speed	Frame
4	10	KT	900	312
6	20	KT	900	326
12	25	KT	900	326
3	30	KT	900	332

With bases, pulleys and compensators. Priced to enable dealers to stock.

SPECIAL QUANTITY PRICE.

MOTORS

55-hp. G.E. CLB 900 r.p.m. D.C., 230 volt.
75-hp. G.E. CLB 900 r.p.m. D.C., 230 volt.
75-hp. G.E. IK, 3 ph., 25 cy., 220 v., 750 r.p.m.
200-hp. Crocker-Wheeler slipring, 485 r.p.m. 3 ph., 60 cycle, 220/440 volt.

LARGE STOCK MOTORS, ALL SIZES, ELECTRIC HOISTS, PUMPS, ETC.

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Almond & Hagert Sts., Philadelphia, Pa.

Turbo Generator Units

1000 kw., 3 phase, 60 cycle, 2300 volt, 3600 r.p.m., horizontal Curtis Turbo-unit.
750 kw., 3 phase, 60 cycle, 2300 volt, 3600 r.p.m., Parsons Turbo-unit.
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Complete with condensers, piping, pumps, exciters, panels with instruments. All in excellent condition.

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Will rewind for any standard voltage

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General Electric Voltage Regulators

5—22 kva., 100 amp., 60 cy., 2200 v., 1 ph., type IRS
3—34.5 kva., 150 amp., 60 cy., 2200 v., 1 ph., type IRS

General Electric Series Arc Rectifier Sets

3—75 Light, type MSO, form DW, 60 cy., 2200 v., rectified amps. 4, rectified volts 6700.

Arc Switchboard Ammeters with Covers

20—4 amp.

Subject to Prior Sale

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Fall River Electric Light Co.
Fall River, Mass.

FOR SALE

250 Kva. Uniflow Set

240-480 V. 60 Cy. 3 Ph. G. E.
Engine 20x24, 200 R.P.M.
Practically new, non-condensing; a bargain.
ROSS POWER EQUIPMENT CO.
Indianapolis, Ind.

3 Phase, 60 Cy. Generators

15 kw., 1,800 r.p.m., 120/240 v. Gen. El.
50 kw., 1,200 r.p.m., 2,300 v. Gen Elec.
50 kw., 1,200 r.p.m., 220/440 v. Gen. El.
60 kw., 900 r.p.m., 2,300 v. El. Mach. Co.
150 kw., 900 r.p.m., 220/440 v. Gen. Elec.
Large stock new and rebuilt Motors.
V. M. NUSSBAUM & CO., Fort Wayne, Ind.

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America's Used Transformer Clearing House
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TRANSFORMER BARGAINS

554 General Electric and Westinghouse 1½ to 100 KVA, 1100/2200 x110/220 volts: nearly all built in 1925 and 1926. Low Prices—Send for List.

Voltage Regulators: Few 100 amp., 60 cycle, single phase, 2300 volt, type IRS, General Electric with current transformer, contact making voltmeter, resistance and relay, $200.00 each. Cash.

TURBO GENERATORS

1—10,000 KVA Westgh. turbo generator.
1—3,750 KVA Gen. Elec. turbo generator with surface condenser.
1—3,750 KVA Gen. Elec. with jet condenser.
1—1,875 KVA G.E. with Wheeler surface condenser (All New).
1—1,250 KVA Gen. Elec. with jet condenser.
1—750 KVA Gen. Elec. New.
1—625 KVA Westgh. bleeder type.
1—625 KVA Gen. Elec. with jet condenser.
2—300 KVA Gen. Elec. with jet condenser.
1—250 KVA Gen. Elec. non-condensing.
1—75 KVA Allis-Moore non-condensing.
1—62½ KVA Westgh. non-condensing.
1—300 KW. 250 V. Westgh. D.C. non-condensing.
1—50 KW. 250 V. Crocker-Wheeler-Terry.
1—25 KW. 125 V. Westgh.
1—No. 4 LeBlanc Condenser.
1—No. 8 LeBlanc Condenser.
2—No. 32 Schutte-Koerting Condensers.
1—720 HP. Gen. Elec. turbine connected to 10,000 cu.ft. 15 lb. centrifugal compressor.

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250 KVA Westgh. Skinner.
185 KVA G.E. Skinner.
150 KW G.E. Ames

Turbo Generators, Various Sizes. Also Large Stock Transformers, Engine Driven Units, Motor Generators, Motors, Dynamos of all Descriptions.

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TRANSFORMERS

3—2000 KVA. Gen. Elec. 55 deg. 48,000 vs. prim. 24,000 vs. secy.
3—1000 KVA. Westinghouse 6600 vs. prim. 2200 vs. secy.
1—750 KVA. Pittsburgh OISC, 40 deg. Furnace Transformer 25000/12500 vs. prim. 280/260/240/220/200/140/130/120/110/100 vs. secy.
3—500 KVA. Gen. Elec. type H, form L, 11,000 vs. prim. 2400 vs. secy.
2—400 KVA. Gen. Elec. type H., form LTQ, 6900 vs. 3 ph. prim. to 230/460 vs. 2 ph., secy.
6—350 KVA. Gen. Elec. 6600 vs. prim. 460 vs. secy.
2—333 KVA. Pittsburgh 2200 vs. prim. 230/460 vs. secy.
3—333 KVA. Allis-Chalmers 2300 vs. prim. 460 vs. secy.
2—330 KVA. Gen. Elec. 6600 vs. prim. 120/240 vs. secy.
3—300 KVA. Pittsburgh 2200 vs. prim. 440/220 vs. secy.
3—250 KVA. Gen. Elec. type H. form KS. 2415/2300/2185 vs. prim. 230/115. secy.
3—200 KVA. Gen. Elec. type H, form KDD, 11500/10925/10350 vs. prim. 2400, secy.
3—200 KVA. Gen. Elec. H, 13,200 vs. prim. 2300/4000 Y, secy.
3—200 KVA. Pittsburgh 13,200 vs. prim. 230/460 vs. secy.
3—150 KVA. Gen. Elec. 2200 vs. prim. 120/240 vs. secy., type H, form RP.
3—110 KVA. Westgh. 13,200 vs. prim. 440/220 vs. secy.
3—125 KVA. Pittsburgh 11,000 vs. prim.—220/440 vs. secy.
3—100 KVA. Westgh. 2400 vs. prim. 440 vs. secy.
3—100 KVA. Pittsburgh 2200/2300/2400 vs. prim. 220/230/240 vs. secy.
3—100 KVA. Westgh. type SK, 13,200/26,400 vs. prim. 2300 vs. secy.
3—100 KVA. Pittsburgh 2200 vs. prim. 220/440 vs. secy.
3—100 KVA. Gen. Elec. H, form KR, 13800/6900 vs. prim. 230/460 vs. secy.
3—100 KVA. Westgh. SK, 13,800 vs. prim. 440/220 vs. secy.
3—100 KVA. Gen. Elec. H, form RP, 6600/13200/11880 vs. prim. 440/545/605 vs. secy.
3—50 KVA. Gen. Elec. H, form K, 2200 vs. prim. 110/220 vs. secy.
3—25 KVA. Westinghouse SK, 22,000 vs. prim. 2200 vs. secy.
2—25 KVA. Allis-Chalmers 2300 vs. prim. 220/110 vs. secy.

ARCHER & BALDWIN, Inc.

126 Liberty St., New York City Telephone—Rector 4025

MOTOR BARGAINS

Variable Speed—230 Volt—D. C.

1—75/100-hp. Westing. SK-210, 200/600 r.p.m.
1—50-hp. Gen. Elec., RF-17, 300/1200 r.p.m.
1—35-hp. Gen. Elec., RF-14, 400/1600 r.p.m.
1—35-hp. Westing. SK-150, 400/1200 r.p.m.
1—30-hp. Westing. SK-130 725/1450 r.p.m.
2—25-hp. Gen. Elec., RF-13, 400/1200 r.p.m.
1—25-hp. Westgh., SK-130, 600/1200 r.p.m.
2—20-hp. Gen. Elec., LC, 750/1500 r.p.m.
2—20-hp. Westing. SK-120, 400/1600 r.p.m.
1—15-hp. Gen. Elec., RF-11, 400/1200 r.p.m.
1—15-hp. Gen. Elec., RF-16, 550/1650 r.p.m.
1—10 hp. Gen. Elec. RF-11, 250/1000 r.p.m.
2—10-hp. Westing. SK-90, 500/1000 r.p.m.
15—7½-hp. Gen. Elec., LC, 450/1350 r.p.m.
See last week's listing

Motors—Generators—Transformers and Other Electrical Equipment

Belyea Co., Inc. 151 W. 18th St. New York City

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LAND

New and Used Selected Bargains

D. C. Motors

H.P.	Make	R.P.M.	Type	
35	G. E.	550	100 B. R.	200
7½	G. E.	850	110 R. C. (New)	

Squirrel Cage Motors (3 Ph., 60 Cy., 220/440)

H.P.	Make	R.P.M.	Type
25	G. E.	1200	K. T.
25	Westghse.	900	C. S.
25	Allis-Chalmers	1200	
25	Robins & Myers	1200	
20	Westghse.	1200	C. C. L.
20	C. W.	1200	
20	G. E.	900	K. T.

Large stock of Motors from ¼ to 300 hp. Also Generators and motor Generator Sets of all characteristics.

L. J. LAND, 207 Centre St., N. Y. C.

THE BULL DOG ½" Drill

UNIVERSAL

only **$48.00**

REGULAR PRICE $72.00

Before you buy a drill—look at this record!

FREE trial for one week!

Try this Bull Dog Drill for one week—abuse it, knock it around, test it any way you wish—if it doesn't take all the punishment you can give it, return it and get your money back!

GET ONE NOW!

Here's a real heavy duty drill that offers you the greatest money saving opportunity. The combined balance and sturdy construction of this drill permits a cutting rate up to 1¾ inches per minute! Recent tests at the New York University laboratory give it the highest and safest class rating of the Electric Power Club. In a performance test this Bull Dog drove a drill through five inches of ordinary stone in seven minutes, without overheating. Two outstanding features are its light weight and its slow speed of only 160 r.p.m. under full load. The seven new innovations embodied in its design, make it the last word in drill perfection.

Absolutely guaranteed for one year!

For sale everywhere or send your order to—

NATIONAL ELECTRIC PRODUCTS CO.

Dept. W. 144 Baxter St., New York, N. Y.

POWER PLANT EQUIPMENT

TURBO UNITS

1—12,500 KW. Westinghouse, 3-60-2300, surface condenser and auxiliaries.
1—6250 KW. Westghse., 2-3-60-2300-13,200.
2—2,500 KW. Gen. Elec. 3-60-6600, bleeder type.
1—2,500 KW. Westinghouse 2-3-60-2200.
1—1,500 KW. Gen. Elec. 2-3-60-2200.
1—1,000 KW. Gen. Elec. 3-60-480, bleeder type.
1—750 KW. Gen. Elec. 3-60-600.
1—600 KW. Gen. Elec. 3-60-2300.
1—500 KW. Gen. Elec. 3-60-440-220-2200.
1—300 KW. Westinghouse 3-60-2400.
1—250 KW. Kerr-Diehl NEW 125 v. d.c.
1—100 KW. Gen. Elec. 3-60-600 v. bleeder type.

BOILERS AND BOILER EQUIPMENT

6—604 HP. straight tube B&W ASME 200 lbs.
3—604 HP. strt. tb. B&W Mass. Std. 208 lbs.
2—302 HP. water tube B&W N. Y. Std. 160 lbs.
4—200 HP. HRT Bigelow Mass. Std. 125 lbs.

COMPRESSORS
(Direct Electric Driven)

3633 cu.ft. Ing.-Rand PRE-2 3 ph., 60 cy., 2300 v.
1730 cu.ft. Chi. Pneu. OCE 3 ph., 60 cy., 2200 v.
1721 cu.ft. Ing.-Rand PRE-2 3 ph., 60 cy., 440 v.
1314 cu.ft. NEW (Any Make) 3 ph., 60 cy., 2200 v.
676 cu.ft. Ing.-Rand XRE-2 3 ph., 60 cy., 2300 v.
528 cu.ft. Pennsylvania 3 ph., 60 cy., 550 v.

Belt Driven

1190 cu.ft. Ingersoll Rand XB-2.
888 cu.ft. Ingersoll-Rand XB-2 "M" Motor 3 ph., 60 cy., 550 v.
877 cu.ft. Ingersoll-Rand XCB syn. Motor 3 ph., 60 cy., 2200 v.
709 cu.ft. Sullivan WJ-3 "CW" Motor 3 ph., 60 cy., 2200 v.
599 cu.ft. Ingersoll-Rand XB-2.
478 cu.ft. Sullivan WJ-3.
250 cu.ft. Chicago Pneumatic NSB.

Steam Driven

5700 cu.ft. Ingersoll-Rand ORC-3.

A. LEE ELLIS
10 High St., Boston, Mass.
"The Buyer Must Be Satisfied Always"

4384 cu.ft. Ingersoll-Rand ORC-3.
2800 cu.ft. Ingersoll-Rand XPV-4 35 lbs.
2588 cu.ft. Ingersoll-Rand OC-3.
1955 cu.ft. Ingersoll-Rand XPV-3.
1531 cu.ft. Ingersoll-Rand XPV-3.
1145 cu.ft. Chicago Pneumatic O-CSC.
823 cu.ft. Ingersoll-Rand XPV-3.
789 cu.ft. Ingersoll-Rand X-4 60 lbs.
599 cu.ft. Ingersoll-Rand X-3.
254 cu.ft. Ingersoll-Rand FR-1.

COAL CRUSHERS, ELEVATORS, CONVEYORS, LARRYS

7—Turbine driven blowers 28,000 to 60,000 cu.ft.
2—5000 HP. Cochrane Open Heaters.
4—17-in. and 10-in.x15-in. Worthington Feed Water Pumps.

ENGINE GENERATOR

1—360 KW. G.E. 3-60-2200-550-440-220, direct connected to a 23-in. x 26-in. stroke, left hand Skinner automatic engine.

M. G. SETS

1—500 KW. syn. Westinghouse 3-60-2300-230 v.
1—150 KW. syn. Westinghouse 3-60-6600-4000-2200-250 v.
1—75 KW. Gen. Elec. 3-60-2300 v. 125 v.
1—50 KW. Gen. Elec. 3-60-550-250 v.

RANDLE

OFFERS BIG BARGAINS
IN

Used and Rebuilt Engine Generator Sets, Turbo Generator Sets, Motors, Rotary Converters, Generators, Motor Generator Sets, Engines, Boilers, Steam and Electric Machinery of all kinds, also Machine Tools. Send for our new machinery list. Yours for the asking. Established Over 50 Years.

The RANDLE MACHINERY CO.
1822 Powers St., Cincinnati, O.

FOR SALE

TURBO-GENERATOR

G. E. 4000-kw., 2300-v.; condenser, Alberger low-head jet type; step-up transformer, 2300/33000-v.; rotaries, 4—400-kw., 600-v., 3-ph.; exciters, 3—100-kw., 125-v. engine driven; motor; 150-hp., 2300-v. synchronous belted; generator; 150-kw. revolving-field belted; switchboard, piping, cables, etc. All 25-cy. Available at once.

SCIOTO VALLEY RWY. & PWR. CO.
Columbus, O.

Generator Sets

2—500 kw., Allis-Chalmers, 440 volt, 3 phase, 60 cycle, direct connected to Nordberg Uniflow Engines, complete with switchboard, exciter, etc.
1—Westinghouse, 780 kva., Turbo Generator Set, 440 volt, 3 phase, 60 cycle.
3—G.E. Curtis Turbo Generator Sets, 2000 kw. each, 2300 volt, complete with transformer, pumps, etc.

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2000 Sangamo Meters

5 to 100 amps. 75% of them perfect, rest slightly damaged. No reasonable offer refused.

Underwriters Salvage Co. of N. Y.
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WANTED

Buyers Everywhere know "Searchlight"

Try an ad for what you wish to sell.

TRANSFORMERS

3—500 kva., oil cooled Type H General Electric, Form LD, sixty cycle, 66,000-2,300 - 600 volts. Condition perfect.

NAZARETH CEMENT CO.
Nazareth, Pa.

WANTED
TURBO UNIT

75 to 125 KW. D.C. 125-volt G. E. Non-Condensing.

FOR SALE
GENERATOR

500 KW. Western Electric 2300 volt 3 phase 60 cy. 3600 r.p.m., Rotary Condenser.

TERMINAL MACHINERY CO.
504-6 Title & Trust Bldg., Seattle, Wash.

If there is anything you want—

or something you don't want that *other* readers of this paper can supply—or use—advertise in the

SEARCHLIGHT SECTION

Somebody is always looking for something to meet certain business needs. Some men in charge of plant operations may be in the market for good used equipment—others may have just what they want, to sell. Some may require a man of unusual qualifications for a particular position—that man may be another reader of this paper!

Put the Searchlight Section to work for you under any of the following classifications—to fill your business needs.

Agencies Wanted
Agents Wanted
Auction Notices
Buildings For Sale
Business Opportunities
Civil Service Opportunities
Contracts To Be Let
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Miscellaneous Wants
New Industries Wanted
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Patents For Sale
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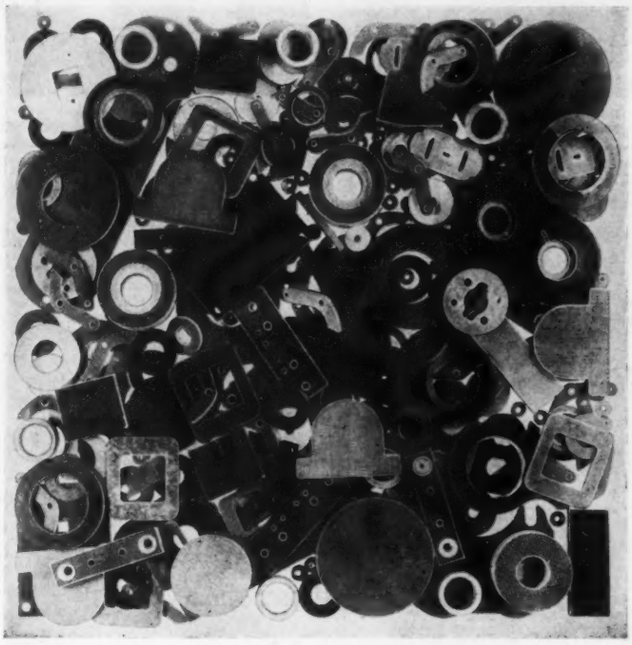
Plants For Sale
Positions Vacant
Positions Wanted
Property For Sale
Receivers' Sales
Representatives Wanted
Salesmen Wanted
Work Wanted
Etc., Etc., Etc.



100 or 1,000,000

Many manufacturers are turning to the FIBROC factory for completely punched or fabricated parts of laminated Bakelite— because they have found them of the highest quality and true to specification.

Because FIBROC combines both high di-electric strength and mechanical strength it is the ideal material for many applications. Stronger than steel of equal weight, FIBROC will withstand a puncture voltage of 320 volts per mil (minimum).

FIBROC is heat resistant, impervious to moisture and is unaffected by atmospheric changes as well as acid fumes, oil, steam or rapidly changing temperatures. It will not swell, shrink, warp or change dimension.

FIBROC is subject to the same machining methods common to wood or metal and with similar tools.

Whether one hundred or one million parts are required, the FIBROC factory is splendidly equipped to furnish finished parts carefully inspected and ready for assembly. We suggest that you get our quotations.

FIBROC is also manufactured in sheets, strips, rods and tubes in standard or special sizes and grades.

FIBROC INSULATION CO.

430 Lincoln Avenue

VALPARAISO, INDIANA

FIBROC

SALES OFFICES IN PRINCIPAL CITIES

14 Good Reasons

Why Leading Electrical Manufacturers Specify MICABOND *Insulation*

THE STANDARD MICA INSULATION

The data given below is the result of careful tests on standard MICABOND by wholly disinterested laboratories.

Test No.		No. 1040 Amber Micabond Super Grade Sample .025 Thick	No. 1020 India Micabond Super Grade Sample .025 Thick
1	Splittings	1" x 1" area	1" x 1" area
2	Dielectric Strength in volts per mil	1,181	999
3	Surface Resistivity, meg-ohms ins. x 10^6	Greater than 30	Greater than 30
4	Volume Resistivity, meg-ohms ins. x 10^6	Greater than 290	Greater than 300
5	Power Factor, percent	3.2	6.0
6	Dielectric Constant	3.7	5.8
7	Slipping at 500° F.	None	None
8	Compression at 500° F. percent	9	1.0
9	Density (Sp. Gr.)	2.54	2.56
10	Transverse Strength, lbs.	7.3	10.7
11	Carbonization	Slight	Slight
12	Corrosion, Resin on Copper	None	None
13	Effect of Heat, 200° F.	None	None
14	Bond Content, percent	4.8	4.9

The above data shows, beyond doubt, that MICABOND more than meets all of the exacting requirements of the electrical industry. For more than twenty-nine years MICABOND has been the Standard Mica Insulation and today, with the most advanced manufacturing methods, MICABOND has established a reputation for dependability and uniformity that has no equal.

[MICABOND is furnished in moulding, segment and heater plate as well as tubes, tape, segments, V rings, washers, discs and moulded or punched parts to specification. Specify MICABOND on your blue prints—submit your insulation requirements for MICABOND prices.]

CHICAGO MICA CO.

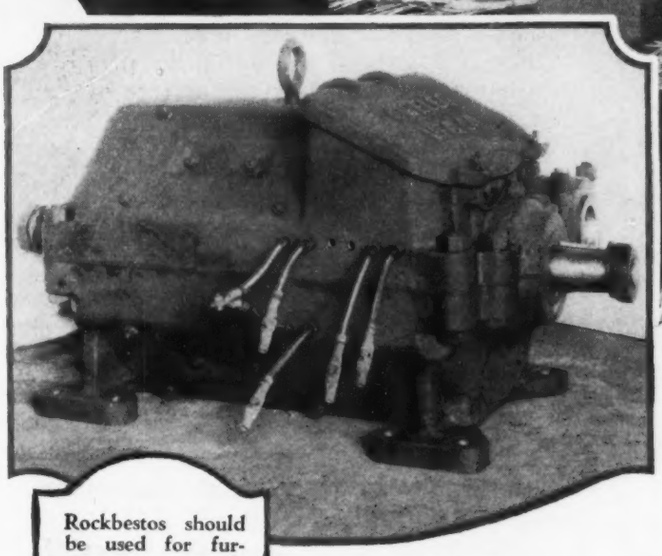
430 Campbell Street, Valparaiso, Indiana

SALES OFFICES IN PRINCIPAL CITIES

MICABOND
THE STANDARD MICA INSULATION

WHY WHEN and WHERE TO USE ROCKBESTOS —the asbestos covered wire

Coils being made of Rockbestos Magnet Wire in the winding room of Crocker-Wheeler Electric Mfg. Co., Ampere, N. J.



Latest type steel mill motor (Form "W") of Crocker-Wheeler Electric Mfg. Co. Its coils are made of Rockbestos Magnet Wire.

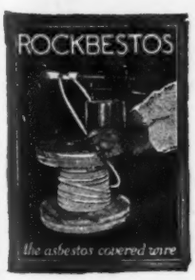
Rockbestos should be used for furnaces, ovens, switchboards, controllers, boiler room lighting circuits, motor leads and internal connections — in fact, wherever wire encounters heat.

How Steel Mill Motors Are Protected Against Temperature Rise

Steel mill motor coils are subjected to intense heat. Temperature rise of motor and severe operating conditions forbid the use of ordinary insulation. It would char or deteriorate with serious consequences.

Example No. 12

Foremost manufacturers of steel mill motors have recognized the superior protective qualities of Rockbestos —the asbestos insulated magnet wire. They wind their coils with it as an assurance of satisfactory performance.



ROCKBESTOS PRODUCTS CORPORATION

NEW HAVEN, CONN.

5942 Grand Central Term. Bldg., New York 465 Union Trust Bldg., Pittsburgh, Pa. 224 Madison Term. Bldg., Chicago

C. Dent Slaughter—On the Pacific Coast.

ENGINEERING SERVICE *in* BAKELITE MOULDING

Now Available to Manufacturers in the Middle West

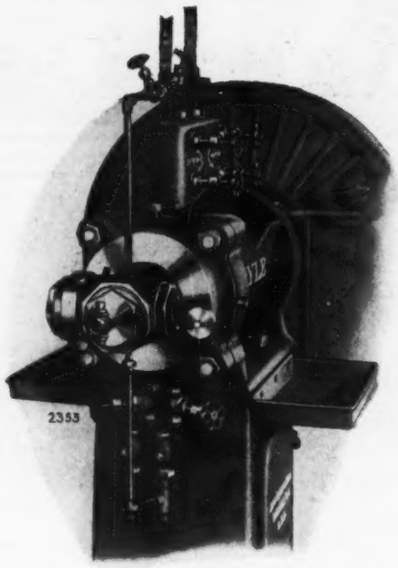
If you are a mid-western Electrical Manufacturer, we are equipped to give you service in Bakelite Moulding. We have a thoroughly experienced Bakelite Engineer ready for personal consulation with you at all times.

A Modern Plant at Chicago

Geared for high production that insures speedy delivery.

Close enough to give you personal service. Write or telephone. Our engineer will call. No obligation on you for this request.

Schneider Brothers
INCORPORATED
304-314 NORTH SHELDON ST.
CHICAGO

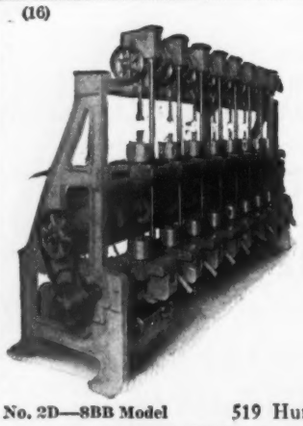


Royle Perfected Insulating Machine No. 2 with side delivery head. Screw size 3¼ inches. Conservative production 150,000 to 200,000 feet of No. 14 code wire per day.

Catalog No. 332 upon request

JOHN ROYLE & SONS
Paterson, New Jersey, U. S. A.

(16)



HIGHER SPEEDS
BALL-BEARINGS
ALEMITE-LUBRICATION

Maximum Dependable Production on AIMCO
Insulation Cover Winding Machines

For covering Round or Rectangular, Solid or Stranded Conductors, with Cotton, Asbestos, Paper, and other Tapes.

"American" INSULATING MACHINERY COMPANY
REG. U.S. PAT. OFF.

No. 2D—8BB Model

519 Huntingdon St., Philadelphia, Pa.

India-Amber-Domestic MICA

We have the largest, most complete stock in the United States.
It comes to us direct from the mines of India and Canada, and we prepare it for every electrical and mechanical purpose in any shape, grade or pattern. Samples furnished and prices quoted.

EUGENE MUNSELL & CO.
New York: 68 Church St. Chicago: 542 S. Dearborn St.

World's largest manufacturers of fine Magnet Wire and Windings

DUDLO

Dudlo Mfg. Company
Fort Wayne Indiana
Division of The General Cable Corp.

TRADE "O.K." MARK — WEATHERPROOF WIRES AND CABLES

WEATHERPROOF
RUBBER COVERED
SLOW BURNING
BARE COPPER WIRE

TRADE "PARAC" MARK — RUBBER COVERED WIRES AND CABLES

PHILLIPS WIRE COMPANY
Division of General Cable Corporation
PAWTUCKET, R. I.

"GARFIELD" INSULATION

GUMMON REG. U.S. PAT. OFF.

"GUMMON" is the standard and original Cold Molded Insulation, made by the oldest and largest producer. Continuously improved to meet increasingly exacting requirements.

GARFIELD MFG. CO.
Garfield, N. J.

Right Down the Line!

TENSILE STRENGTH—
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DIELECTRIC STRENGTH—
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WORKABILITY—
O.K.—Production Dept.

COST—
O.K. accounting Dept.

APPEARANCE—
O. K. Sales Dept.

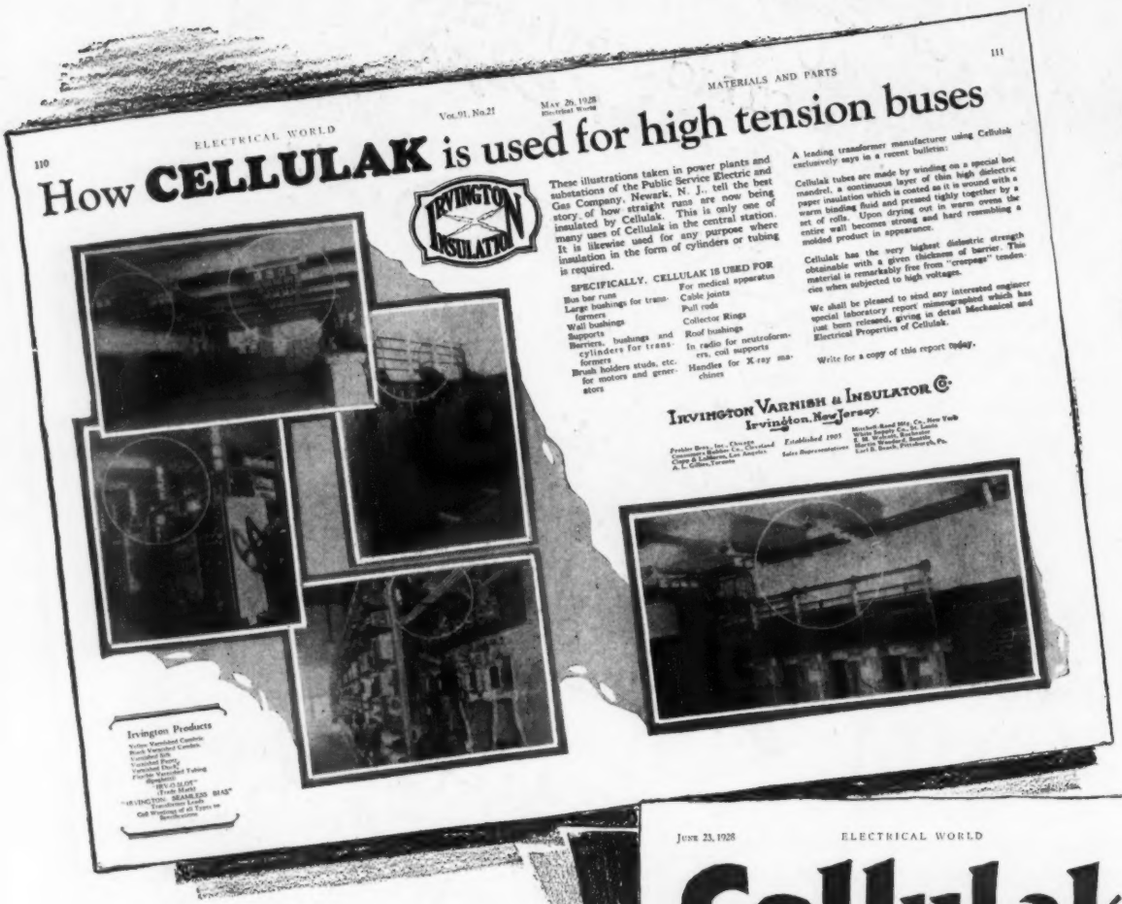
NATIONAL VULCANIZED FIBRE

"—the material with a million uses"

NATIONAL VULCANIZED FIBRE CO., Wilmington, Del., U. S. A.

Makers of laminated insulation since 1873
Offices in Principal Cities

Cellulak


ELECTRICAL WORLD
MATERIALS AND PARTS
How CELLULAK is used for high tension buses
IRVINGTON INSULATRON
These illustrations taken in power plants and substations of the Public Service Electric and Gas Company, Newark, N. J., tell the best story of how straight runs are now being insulated by Cellulak. This is only one of many uses of Cellulak in the central station. It is likewise used for any purpose where insulation in the form of cylinders or tubing is required.
SPECIFICALLY, CELLULAK IS USED FOR
Bus bar runs
Large bushings for transformers
Wall bushings
Supports
Barriers, bushings and cylinders for transformers
Brush holders studs, etc. for motors and generators
For medical apparatus
Cable joints
Pull rods
Collector Rings
Roof bushings
In radio for neutroformers, coil supports
Handles for X-ray machines
A leading transformer manufacturer using Cellulak exclusively says in a recent bulletin:
Cellulak tubes are made by winding on a special hot mandrel, a continuous layer of thin high dielectric paper insulation which is coated as it is wound with a warm binding fluid and pressed tightly together by a set of rolls. Upon drying out in warm ovens the entire wall becomes strong and hard resembling a molded product in appearance.
Cellulak has the very highest dielectric strength obtainable with a given thickness of barrier. This material is remarkably free from "creepage" tendencies when subjected to high voltages.
We shall be pleased to send any interested engineer special laboratory report mimeographed which has just been released, giving in detail Mechanical and Electrical Properties of Cellulak.
Write for a copy of this report today.
IRVINGTON VARNISH & INSULATOR CO.
Irvington, New Jersey
Irvington Products

for high tension buses

JUNE 23, 1928 ELECTRICAL WORLD 31
Cellulak
PROTECTED
IRVINGTON INSULATRON
This transformer is a typical one showing how Cellulak is used for insulation and support of certain parts. It is a 450-kva. 3 phase, 60 cycle transformer, 66000 volt primary, with 13800 volt secondary and was built for use on the lines of the Tennessee Public Service Company, Morristown, Tennessee.
To those engineers interested we shall be pleased to send samples of Cellulak used for transformers, cable joints or large bushings. We shall be pleased to send any interested engineer special laboratory report mimeographed which has just been released, giving in detail Mechanical and Electrical Properties of Cellulak.
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Cellulak TRADE MARK
IRVINGTON VARNISH & INSULATOR CO.
Irvington, New Jersey

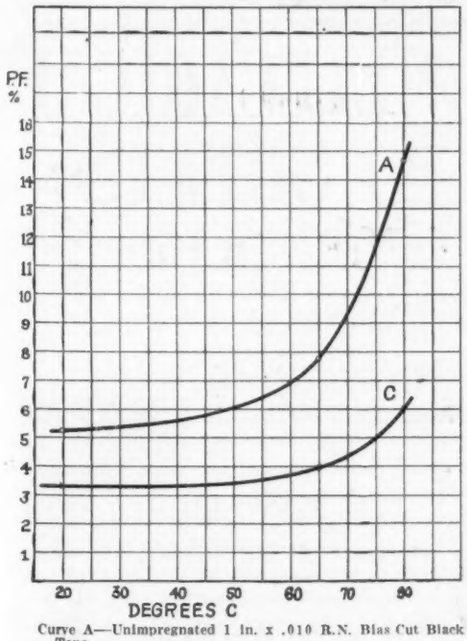
for transformers

and now for Cellulak wrapped High Tension Insulated Bushings and Busbars

Many utilities are now having their high tension and square buses covered with Cellulak. This does away with hand wrapped insulation. It is also better than tubes since it eliminates air spaces and possible gas voids.

Customers supply the round or square bus and Irvington applies the Cellulak. Maximum lengths 80 inches. Full details, prices and deliveries upon requests.

IRVINGTON Seamless Bias low loss tape and conical tubes



Curve A—Unimpregnated 1 in. x .010 R.N. Bias Cut Black Tape.
Curve C— Low Loss Tape.
Tape used from Same Roll Throughout.
40 Mils. Stress, 50 Volts per mil.
4 Layers Wound on ½-in. Mandril. Wall Electrode, 6 inch, ½ inch Guard Rings.

The electrical characteristics of Low Loss Tape are obtained by a process of evacuation and impregnation with a carefully selected vacuum treated oil followed by a lengthy treatment under hydrostatic pressure. The result as shown by the graph is a very greatly decreased power factor with straight line characteristics up to normal operating temperature of the cable. The S. I. C. is very close to that of oil impregnated paper. Long life tests under electrical stress have proved the superiority of this material over unimpregnated tape. The cost for equivalent thickness of insulation is less than that of oil impregnated paper.

Full details will be gladly supplied.

IRVINGTON VARNISH & INSULATOR CO.
Irvington, New Jersey.

Established 1905

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Martin Woodard, Seattle
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Deltabeston

THE WIRE WITH THE LONG ASBESTOS FIBRE

For lowered maintenance costs

The constant overheating of coil windings is more destructive to motors or generators than either age or wear. You will rarely need the services of a repair man on these classes of apparatus if the coils are wound with Deltabeston magnet wire. This wire is insulated with pure, long-fibre asbestos, and its heat-resisting qualities will protect your equipment. It has the same outside diameter as cotton covered magnet wire, therefore, you can wind a coil with the same number of turns.

Send for samples and literature

YORK INSULATED WIRE WORKS
OF GENERAL ELECTRIC COMPANY
120 Broadway, New York

Resists Water DELTABESTON WIRE REG. U.S. PAT. OFF. *Resists Heat*

Torsion Test

Crapo
Galvanized Products

Telephone and Telegraph Wire

Steel Strand

TOUGHNESS and pliability are essential characteristics in all wire where stress is involved. These important qualities are carefully controlled in our products by the Torsion Test which is regular routine in our laboratories.

Crapo Galvanizing is positive insurance of low maintenance cost and long life. Insist upon *Crapo* Galvanizing! There is no substitute.

Representative Supply Jobbers are prepared to fill your requirements for *Crapo* Galvanized Wire and Strand on instant notice.

Indiana Steel and Wire Company
Muncie, Indiana. U.S.A.

NEWPORT ELECTRICAL SHEETS
BEST BY TEST

Made for Your Particular Requirements

Are you interested in securing sheets distinctive for uniformity, low core losses, high permeability and exceptional punching qualities?

We maintain, at your service, a highly specialized department for the production and betterment of Electrical Steel sheets.

Submit Your Inquiries

THE NEWPORT ROLLING MILL CO.
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D. M. STEWARD MFG. CO.
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For Forty Years the leading heat resisting insulation Manufacturers. Ask about

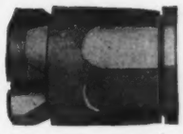
"LAVITE"

Superior Insulated Staples
GRADE B

The rust-proof low price staple for all low potential wiring. Packed in cartons of 1,000. Immediate shipment.

SUPERIOR MFG. CO.
20 Main St., Fitchburg, Mass.

TYPE LB — Oblong Series, KONDU Threadless Fitting, ½ in. to 4 in.

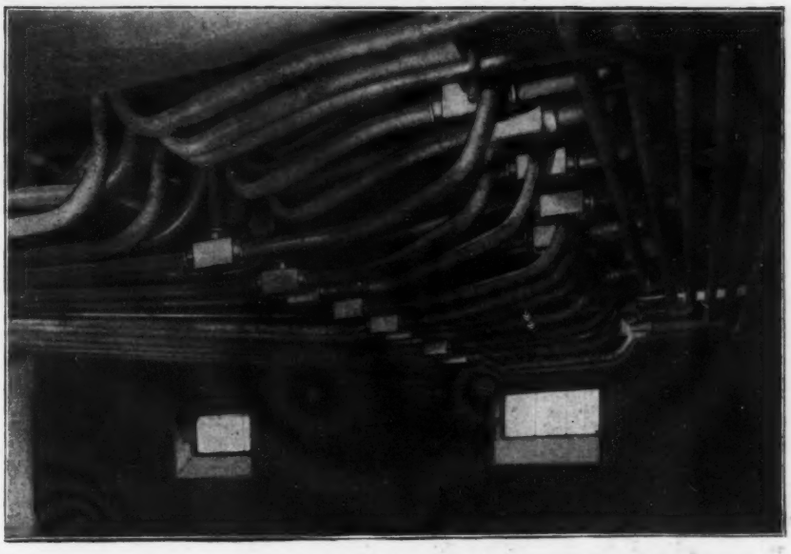


TYPE KO—KONDU Knock-out Box Connector, ⅜ in. to 1¼ in.

TYPE KOR — KONDU Reducer for Knockout or Panel Box Connections.

TYPE T — Oblong Series KONDU Threadless Fitting, ½ in. to 4 in.

TYPE H — KONDU Threadless Coupling, Octagon, ½ in. and ⅜ in. only.



A substation wiring job where KONDU proved its money saving features.

Note the numerous turns, bends and crossovers. It's easy with KONDU because it is not necessary to rotate either the conduit or fitting.

As Easy as A-B-C

INSTALLING Erie Malleable KONDU Threadless Fittings is as easy as your A-B-C's!

No more threading of conduit—no screwing up in tight places—no bending and pounding after the conduit is installed. With KONDU Threadless Fittings the conduit is simply cut to length, shaped to fit—the KONDU Boxes slipped on and the lock-nuts tightened.

On any job KONDU Threadless Fittings save money, speed up the work. Once installed, it is a simple matter to remove a KONDU Box for replacement of another type, or to add new fittings to any part of the line without disturbance.

There is a KONDU Threadless Fitting for every purpose—to amply fulfill every need.

Write today for the new, illustrated catalog, and complete information.

THREADLESS KONDU BOX FITTINGS

The Erie Malleable Iron Co.

ERIE, PENNA.

Kondu Division

THREADLESS KONDU BOX FITTINGS

AMBLER

ASBESTOS CORRUGATED

used by utilities and
manufacturing plants
as Roofing and Siding

AMBLER

ASBESTOS LUMBER

Approved by Underwriters Laboratories,
used extensively by Public Utilities
and Electrical Manufacturers.

AMBLER

EBONIZED ASBESTOS LUMBER

Meets U. S. Navy Specifications.
Approved by Underwriters Laboratories.
In universal use by Utilities and Electrical
Manufacturers.

AMBLER

Asbestos Shingles—Linabestos—
Waltile—Cold Molded Products

Asbestos
Shingle, Slate and Sheathing
Company

BRANCHES
Boston, Mass.
Buffalo, N. Y.
Chicago, Ill.
Cleveland, Ohio
Detroit, Mich.
Milwaukee, Wis.
Minneapolis, Minn.

Factories at
Ambler, Pa.
St. Louis, Mo.

BRANCHES
New York, N. Y.
Omaha, Nebraska
Philadelphia, Pa.
Pittsburgh, Pa.
Washington, D. C.
Wilkes-Barre, Pa.
St. Louis, Mo.

ONE

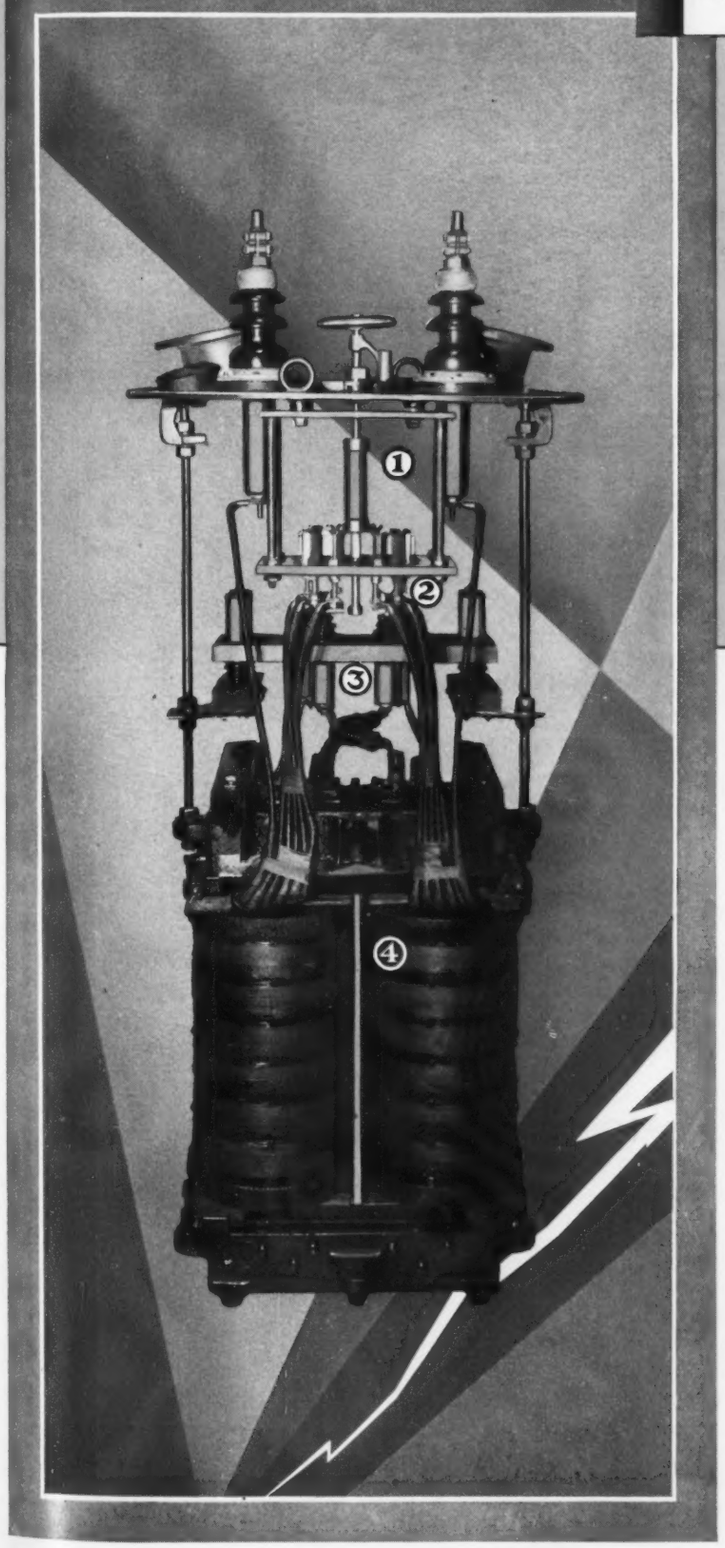
"Strain insulator," used between transformer and ground. This insulator is made from Celoron tubing because it must be accurately machined to thread with metal end-caps. It must withstand severe pressure and twisting strain, as well as high voltages.

TWO

Tap changer board. No other type of material could answer the requirements of this part as perfectly as Celoron. Intricately machined, drilled, tapped and milled—it is a veritable skeleton in its finished form. Yet it possesses ample mechanical strength and durability to properly serve its purpose.

THREE

Fourteen Celoron tubes have been utilized as "spacers" in this transformer. The specifications called for a good insulation with rugged mechanical strength. Naturally, Celoron was the answer.



FOUR

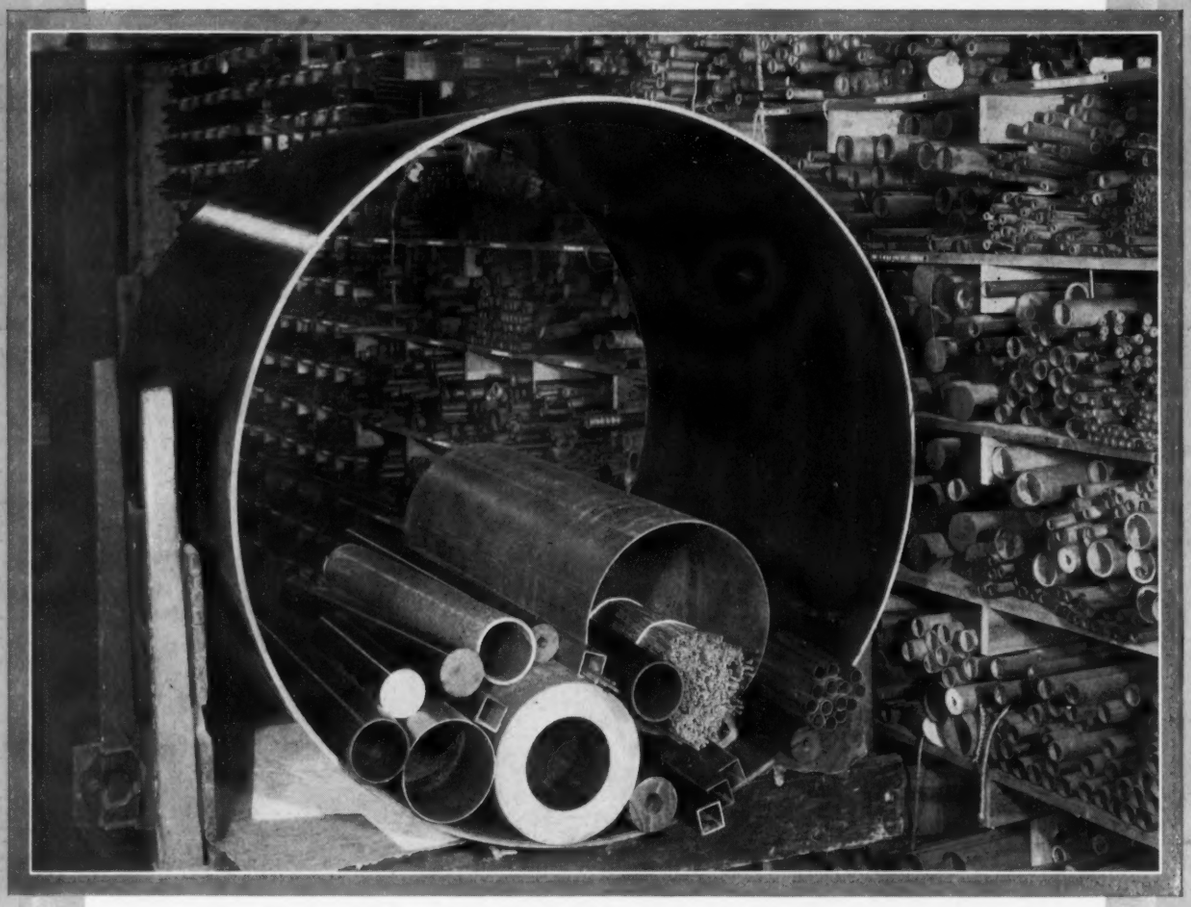
Celoron "Barrier." This barrier used between the coils is 15 inches wide and ¼ inch in thickness, providing a broad margin of safety. Celoron was selected because a sheet this thickness would withstand 80,000 volts or more, if required.

Celoron Helped Packard
Simplify transformer Construction

Because Celoron is not only a high-grade insulation that is immune to climatic conditions, but because it is also capable of assuming real structural responsibilities—Celoron Insulation was selected by the Packard Electric Company of St. Catharines, Canada, to assist in the new designing of Packard Transformers.

Through the use of Celoron sheets and tubes for the purposes here outlined, construction has been greatly simplified and strengthened. Assembly has been facilitated. Efficiency has been increased. Appearance has been improved. Unfailing dependability is now assured throughout a materially lengthened useful life.

CELORON
INSULATION



WHAT SIZE, PLEASE?

Celoron Insulating Tubes and Rods (made of that same high quality material as Celoron sheet insulation) range in size from 1/8 inch I.D. to 4 feet I.D., and over. The wall thickness of Celoron tubing is unlimited—and can be made as thin as 1/32 inch.

Both rods and tubes are supplied square and rectangular, as well as round. They are made in a variety of lengths. They can be supplied drilled, turned, bored, reamed, counterbored, threaded, or chased, specially to your requirements.

Thousands of dollars have been invested in the machinery that produces this limitless assortment of Celoron Tubes and Rods serving every requirement of the electrical industry.

For Celoron has become so universally used by great electrical enterprises, and has become so vital a contributing factor in the successful accomplishment of outstanding electrical developments—that The Celoron Company regards it *an obligation* to produce this improved insulating material in shapes to meet even the most extreme and highly specialized requirements. To produce Celoron in quantities to satisfy the enormous production schedules of modern business. To maintain at all times large stocks in conveniently located warehouses all over the country, so that immediate delivery of Celoron in any shape or form can be depended upon.

Take advantage of this unusual service. Let Celoron tubes, rods, sheets, and machined parts solve your own insulation and production problems. Send us your blue prints for estimates and samples.

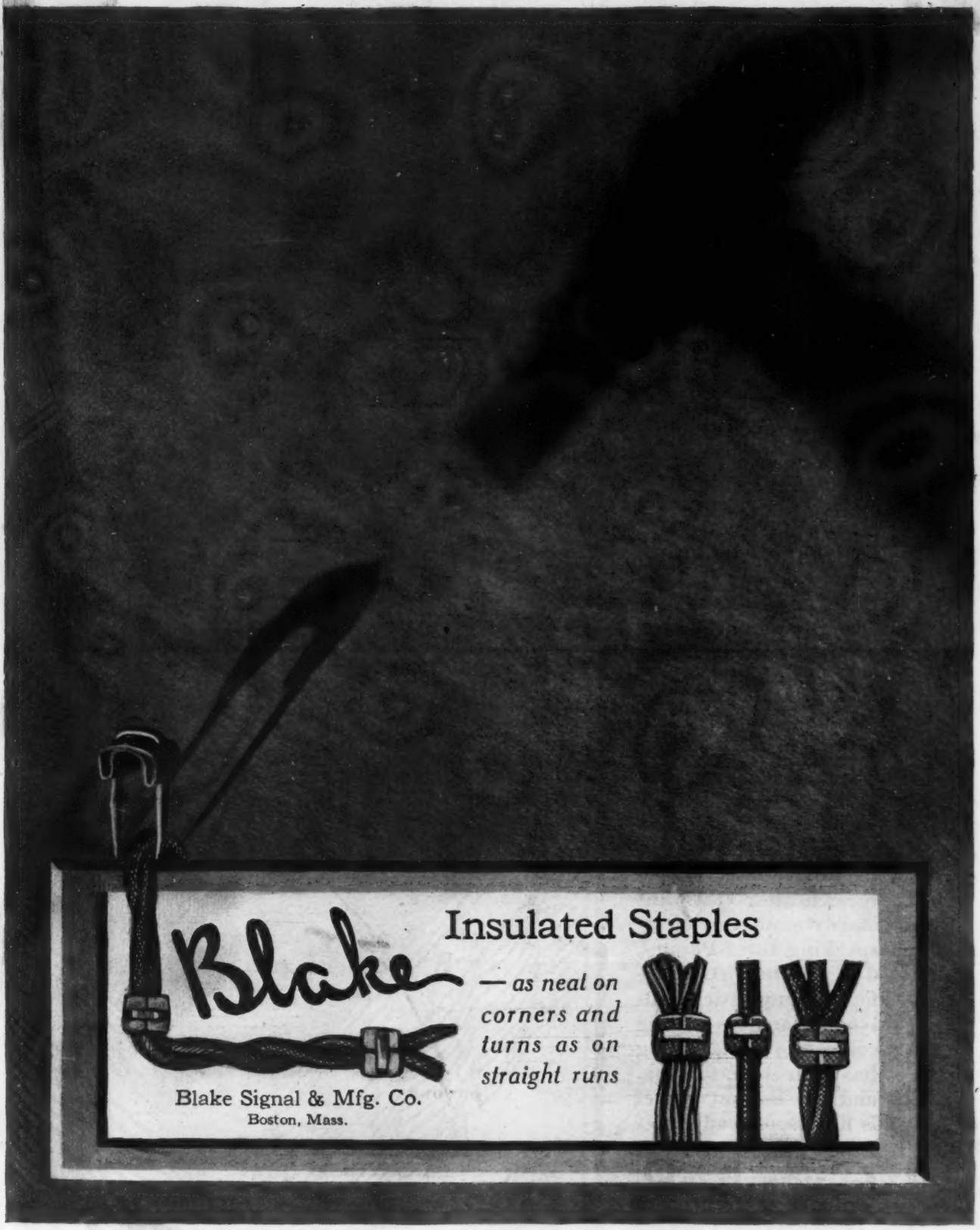
THE CELORON COMPANY
BRIDGEPORT, PENNSYLVANIA
In Canada: 350 Eastern Avenue, Toronto

Celoron Products Include:

Celoron Molding Powders; Impregnated Fabrics and Paper for Molding; Synthetic Resins, Varnishes, and Cements; Laminated Celoron sheets, rods, and tubes for radio, electrical, and industrial purposes; Celoron Silent Gears.

CELORON INSULATION

DIVISION *of* DIAMOND STATE FIBRE CO.
Established 1891



Using an uninsulated staple or nail is about the equivalent of using an uninsulated telephone wire . . . Since you demand insulation on the wire, we have provided it on the staple.

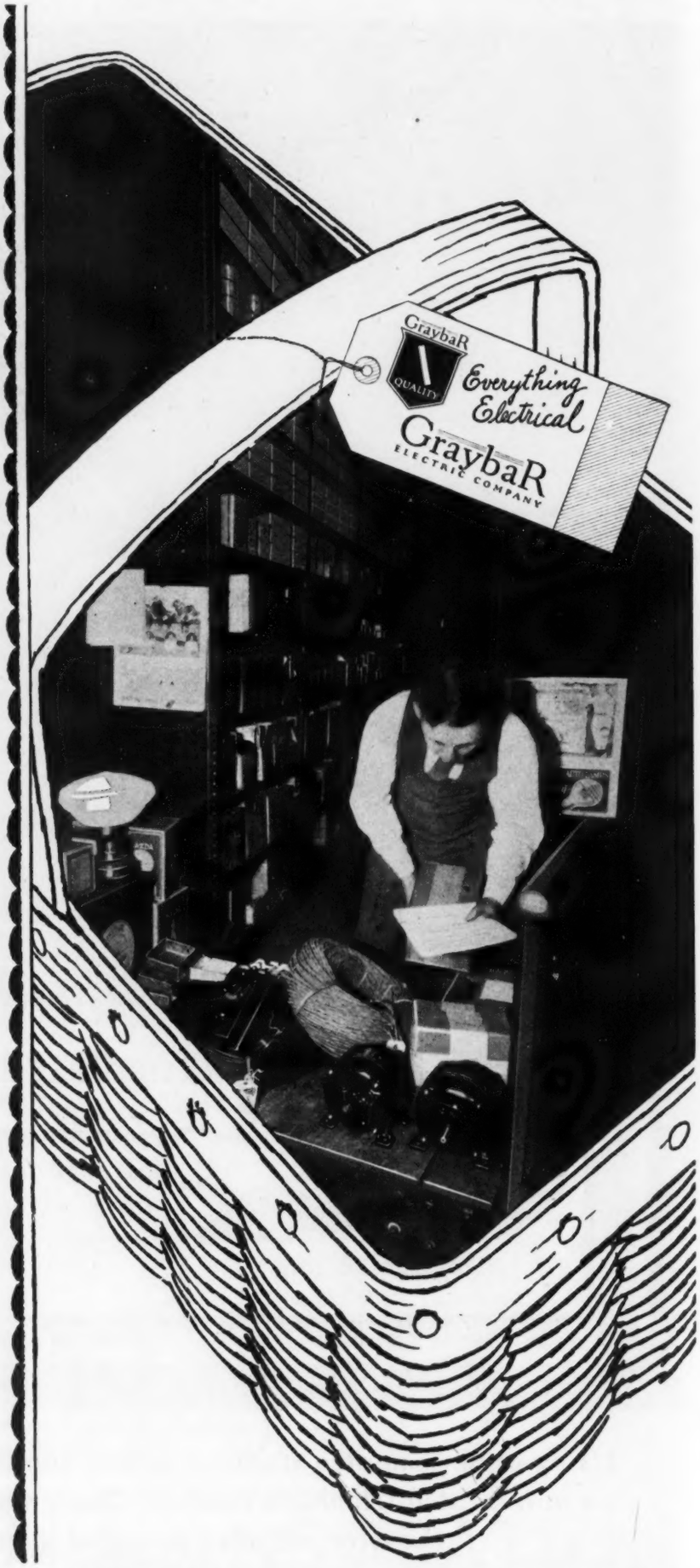
It's easy to choose from 60,000 items

in this electrical market basket

How simple this business of buying electrical equipment has become—thanks to those supermarket baskets, the Graybar distributing houses.

No need to make a dozen different efforts to get a dozen articles. No need to worry how far away the maker's factory is.

Everything you could possibly need is already gathered together for you, no farther away than the nearby Graybar distributing house. No matter whether you want sturdy motors or clear-speaking Inter-Phones, dependable wire or efficient lamps, stick-to-it-ive tape or time-defying cable—your marketing has been done for you, and the market basket is filled and ready.

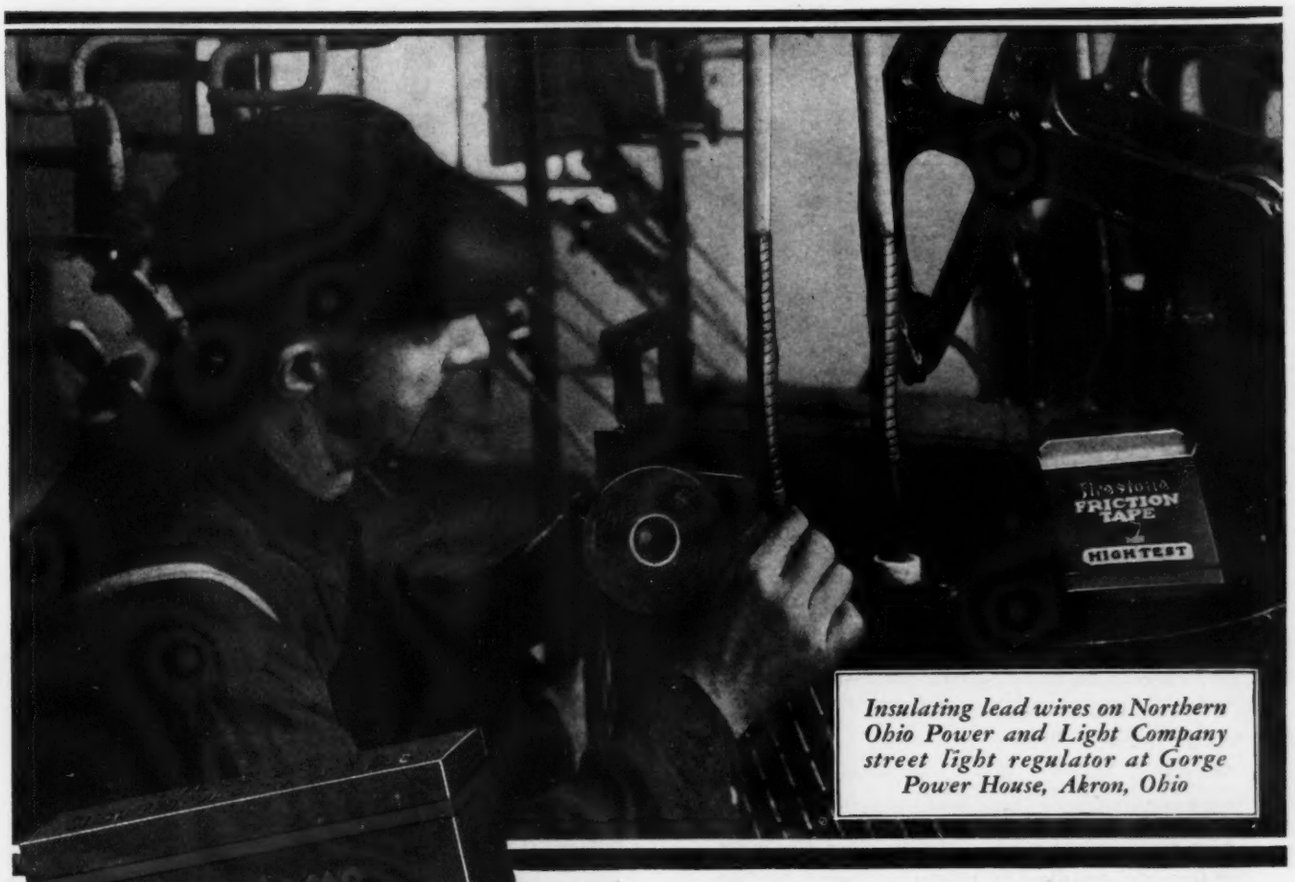


GraybaR

Successor to *Western Electric* Supply Dept.

THE GRAYBAR TAG · SYMBOL OF DISTRIBUTION

OFFICES IN 70 PRINCIPAL CITIES ◇ EXECUTIVE OFFICES, GRAYBAR BLDG., LEXINGTON AVENUE AND 43RD STREET, NEW YORK



Insulating lead wires on Northern Ohio Power and Light Company street light regulator at Gorge Power House, Akron, Ohio

LONG LIFE—

and easy handling make this the world's most economical tape:

Firestone has specialized in making a tape that is easy to apply—that quickly fuses into a one-piece jacket, giving the advantages of a solid coupling—cutting taping time and taping costs. The tacky, adhesive rubber clings wherever you place it, providing tight, snug-fitting insulation—the only kind for sure protection of expensive equipment. Safety, easy handling and infrequent replacement make Firestone High-Test Tape the most economical on the market. We invite your inquiries concerning specifications and prices. Packed in bulk for the shop and in display cartons for retail. Write the nearest Branch or the Home Office, at Akron, Ohio.

The Mark of Quality

Firestone

FRICTION TAPE

AMERICANS SHOULD PRODUCE THEIR OWN RUBBER . . Harvey S. Firestone

MARING WIRE COMPANY
MUSKEGON MICHIGAN
MARINGRAM
MARING PROCESS
MARING SETS ITS OWN STANDARDS FOR MANUFACTURING, SPOOLING AND SHIPPING GOOD MAGNET WIRE.

STANDARD requirements are met, of course, in the manufacture of MARING Magnet Wire—but "MARING" does not stop there. When a spool or reel of MARING Magnet Wire leaves our plant it represents more than just so much "wire."

For each spool and reel combine the best materials, applied to manufacturing by the most improved "MARING" methods and tested by the most rigid "MARING" standards.

Finest manufacture is followed by perfect spooling on true, light-weight spools which insure a perfect balance. A shipping standard that is unexcelled next insures delivery to you only in the best condition.

These MARING Standards are reasons enough for the acceptance of MARING Magnet Wire as "The Nation's Finest Value in Magnet Wire."

May we send a representative from one of our Nine Branch Offices to give you unbiased advice without obligation?

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Magnet Wire

BRONZE
Parallel Clamps

With Everdur Bolts-Nuts Lockwashers

High conductivity for all cable sizes.

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Transmission Lines
To Meet Every Requirement
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HARD PORCELAIN
For Electrical Specialties
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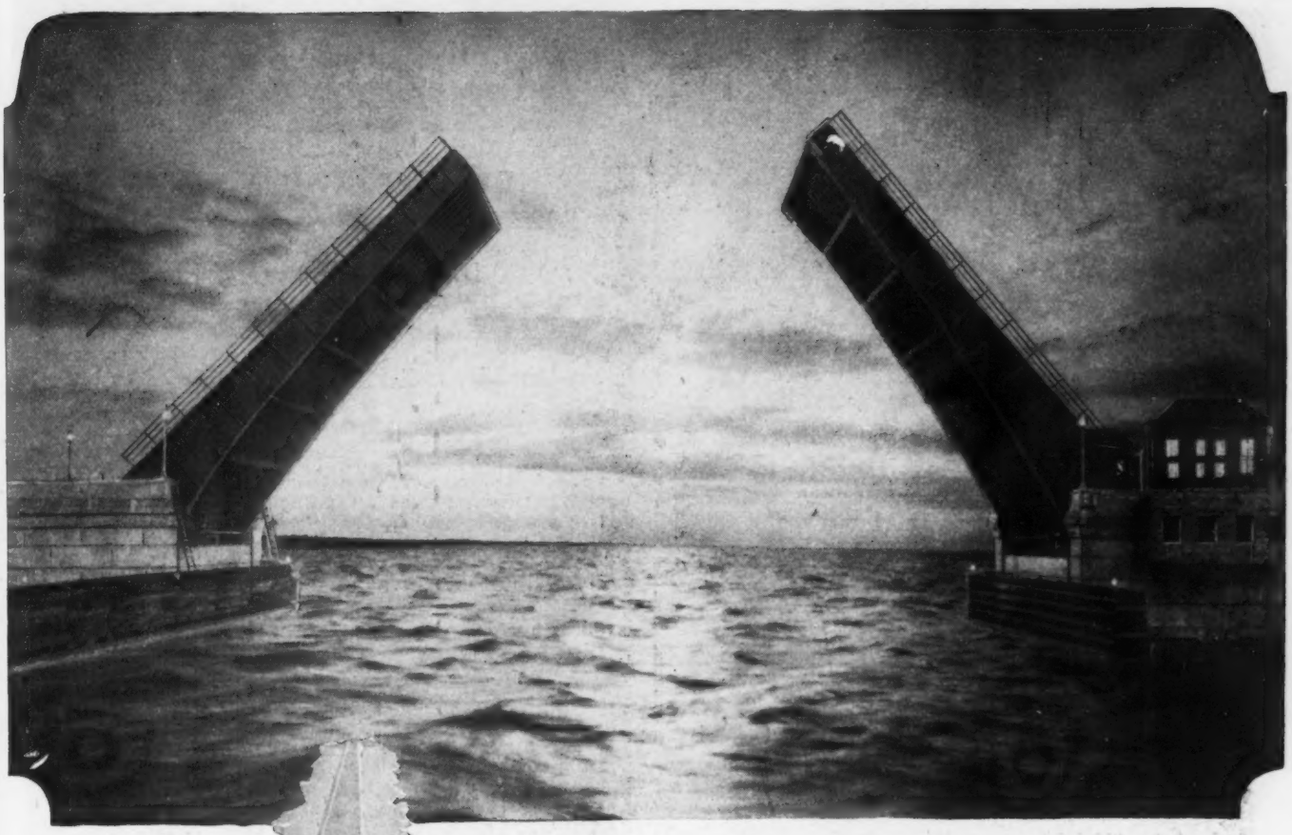
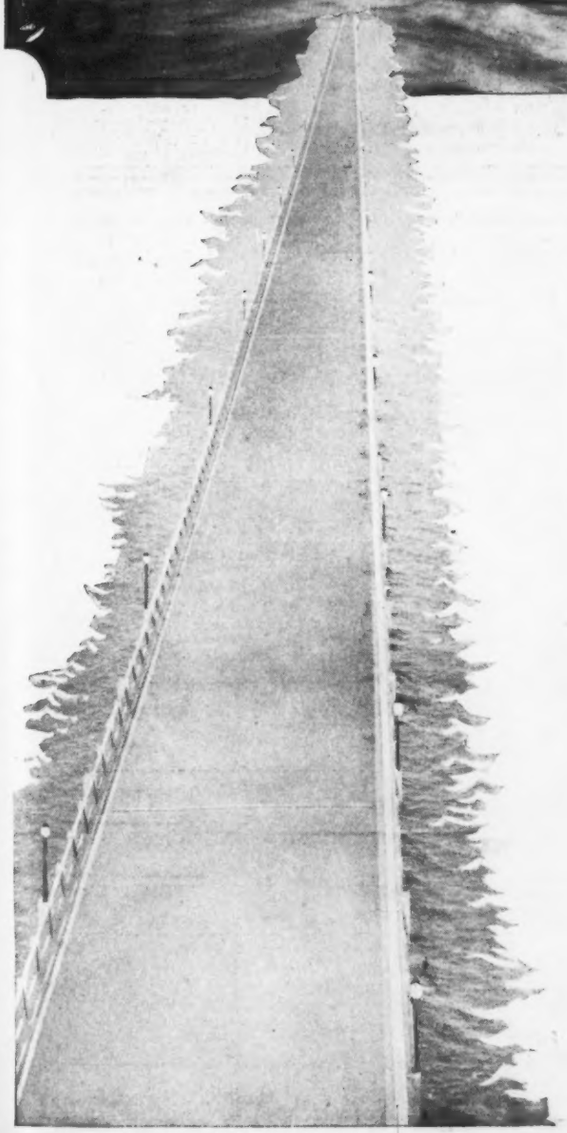
TRENTON, N. J

INSULATED SAFETY WIRES & CABLES

RUBBER—PAPER—CAMBRIC INSULATED CABLES

SAFETY CABLE COMPANY
Division of General Cable Corporation
CHICAGO NEW YORK BOSTON
SAN FRANCISCO





Pontchartrain Bridge wired for Power and Lighting with

SIMPLEX CABLES

Pontchartrain Bridge—that great concrete highway trestle which extends across Lake Pontchartrain, for almost five miles, is wired for power and lighting with Simplex Cables.

Specified on projects where first class cable performance must be maintained Simplex Cables assure positive results.

Simplex products are made in a factory equipped with modern machinery, operated by skilled workmen and supervised by engineers who know how to produce cables that are second to none. Ample testing facilities keep a check on materials and workmanship to insure highest possible success during construction as well as upon completion of the cables.

An efficient engineering staff is always available for consultation regarding wire and cable problems.

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For Electrical Insulation

Tested and approved by the Underwriters' Laboratories.

High tensile and dielectric strength. Used successfully by many of the large electrical manufacturers.

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RUBBER COVERED WIRE *for* INTERIOR WIRING

Highest Standard of Excellence
Send for descriptive book

American Steel & Wire Company
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PATENTED SEAMLESS TUBING COIL GENERATOR
IMPROVED ONE PIECE BURNER
PATENTED ARRANGEMENT FOR DISLODGE-ING COIL WITHOUT TEAR-ING DOWN FURNACE
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Gasoline—Kerosene

Especially designed to withstand the abuse of Splicing Service.

50 lbs. of solder melted in **10 minutes.**

But More Important—the length of timethey will remain in the field, free from trouble common to the average furnace will surprise the most experienced user.

We'll name Public Utilities with over **1,000 Unique** Furnaces inuse.

May we send proof? Write for descriptive literature.

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Varnished Insulations
Coil Windings
Magnet Wire (all insulations)
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ACME Coil Windings have helped manufacturers to improve their products for 20 years. Acme ignition, radio transformer and choke coils, and meter, controller, generator and field coils are splendid examples of the economical, yet highly efficient, way in which coils of many turns can be wound on our high-speed automatic machines. *Write for detailed catalog insert.*

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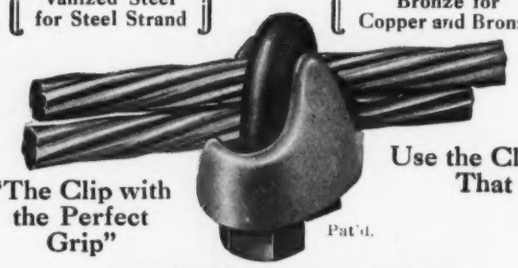
THE ACME WIRE CO., NEW HAVEN, CONN.

Made of Galvanized Steel for Steel Strand

Made of Special Bronze for Copper and Bronze



"The Clip with the Perfect Grip"

Use the Clip That Fits

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"WIRE-LOCK"

WIRE-LOCK CLAMP COMPANY
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NON-RUSTING

"COPPERWELD"

Wire—Strand—Rods

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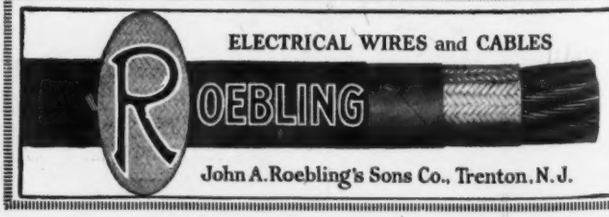
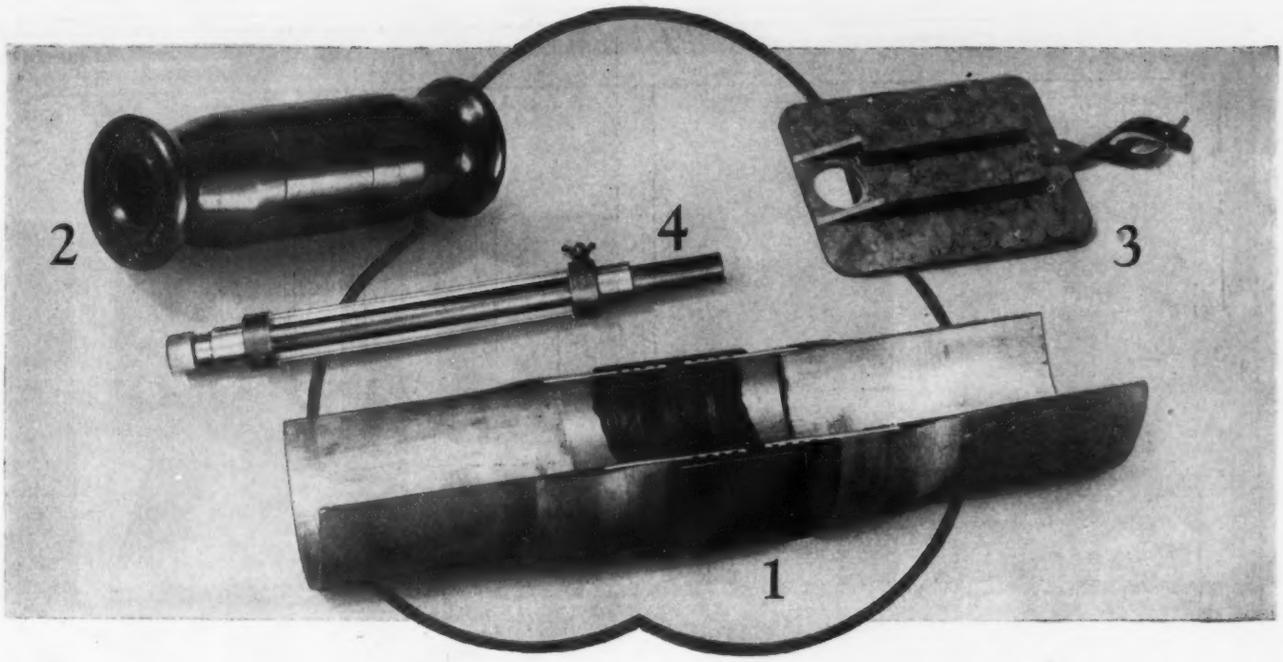
There is no other "copper covered steel" or "copperclad steel" made like "COPPERWELD"—by the molten welding process.

ELECTRICAL WIRES and CABLES



John A. Roebling's Sons Co., Trenton, N.J.



Bakelite Materials in Central Station Service

IT frequently happens that apparatus and equipment for the generation and transmission of power requires insulation possessing properties in addition to high dielectric strength. In some instances, exceptional toughness and strength are essential, in others it is moldability, dimensional accuracy, or resistance to moisture, heat or chemical action.

A few examples of the successful use of Bakelite Materials are shown above. No. 1 is an insulating sleeve used on a 66,000 volt A.C. single conductor cable. The sleeve is made of two short lengths of brass tubing, separated by a Bakelite Molded joint, the purpose of which is to interrupt metallic continuity.

No. 2 is a heavy duty cable connector for 60 ampere, 250 volt circuits. The connector is an assembly of four parts, and dimensional accuracy is essential. Bakelite Molded provided the insulating properties required and could also be formed to exact dimensions.

No. 3 is an instruction card-holder, used on the disconnects on the switchboards of a large Central Station. Each one is formed in one piece of a fabric base Bakelite Molding Material possessing exceptional toughness and strength, and capable of resisting hard and abusive service.

No. 4 is a Super-Power Fuse. Within the glass outer chamber is a Bakelite Laminated tube which carries the arc resisting liner and the fuse wire. In a series of sixteen successive tests at 10,000 k.v.a. 33,000 volts, the same Bakelite Laminated tube came through unimpaired.

Much valuable information upon Bakelite Molded and Bakelite Laminated will be found in Booklets I.M. and I.L., copies of which will be mailed promptly upon request.

Bakelite Engineering Service

Intimate knowledge of thousands of varied applications of Bakelite Materials combined with eighteen years' experience in the development of phenol resinoids for electrical uses provides a valuable background for the co-operation offered by our engineers and research laboratories.

BAKELITE CORPORATION

247 Park Avenue, New York, N. Y. Chicago Office, 635 West 22nd Street

BAKELITE CORPORATION OF CANADA, LTD., 163 Dufferin Street, Toronto, Ont.

BAKELITE

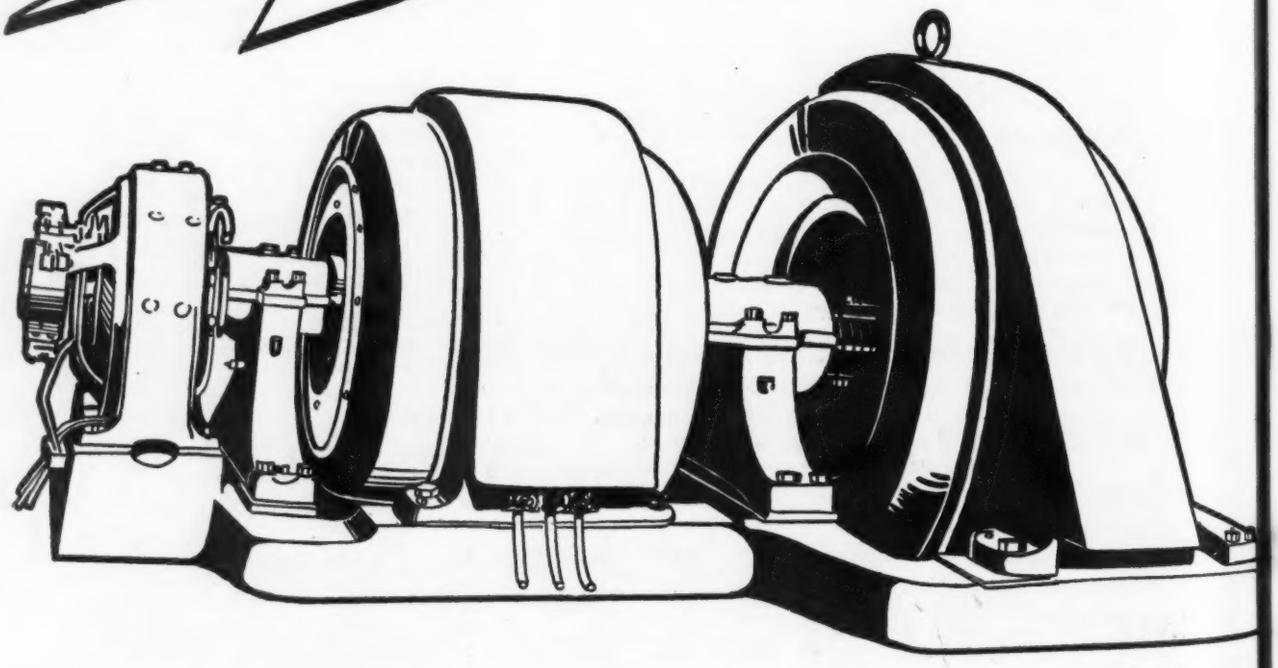
REGISTERED U. S. PAT. OFF.

THE MATERIAL OF A THOUSAND USES

"The registered Trade Mark and Symbol shown above may be used only on products made from materials manufactured by Bakelite Corporation Under the capital "B" is the numerical sign for infinity, or unlimited quantity It symbolizes the infinite number of present and future uses of Bakelite Corporation's products."

EMPIRE

ELECTRICAL



SHEETS

SPEED In Handling Orders Is an Empire Motto!

Speed! Due to our modern service system, we make one shipping record—only to break it by another. Speed in handling electrical sheet orders is an Empire motto!

Nor is perfection of product sacrificed to speed. No electrical sheets qualify for higher electrical and magnetic honors. They're clean—inside and out.

Unusual care assures uniformity in annealing and analysis. The most rigid tests known to science and our label on every tenth sheet, guarantees perfection of performance to satisfy the most exacting. Of course, Empire sheets punch cleanly and stack easily.

Empire admits no superior in product or promptness of delivery. Ask us what we can do on your next order.

EMPIRE STEEL CORPORATION

MANSFIELD, OHIO

Successors to The Mansfield Sheet & Tin Plate Co.

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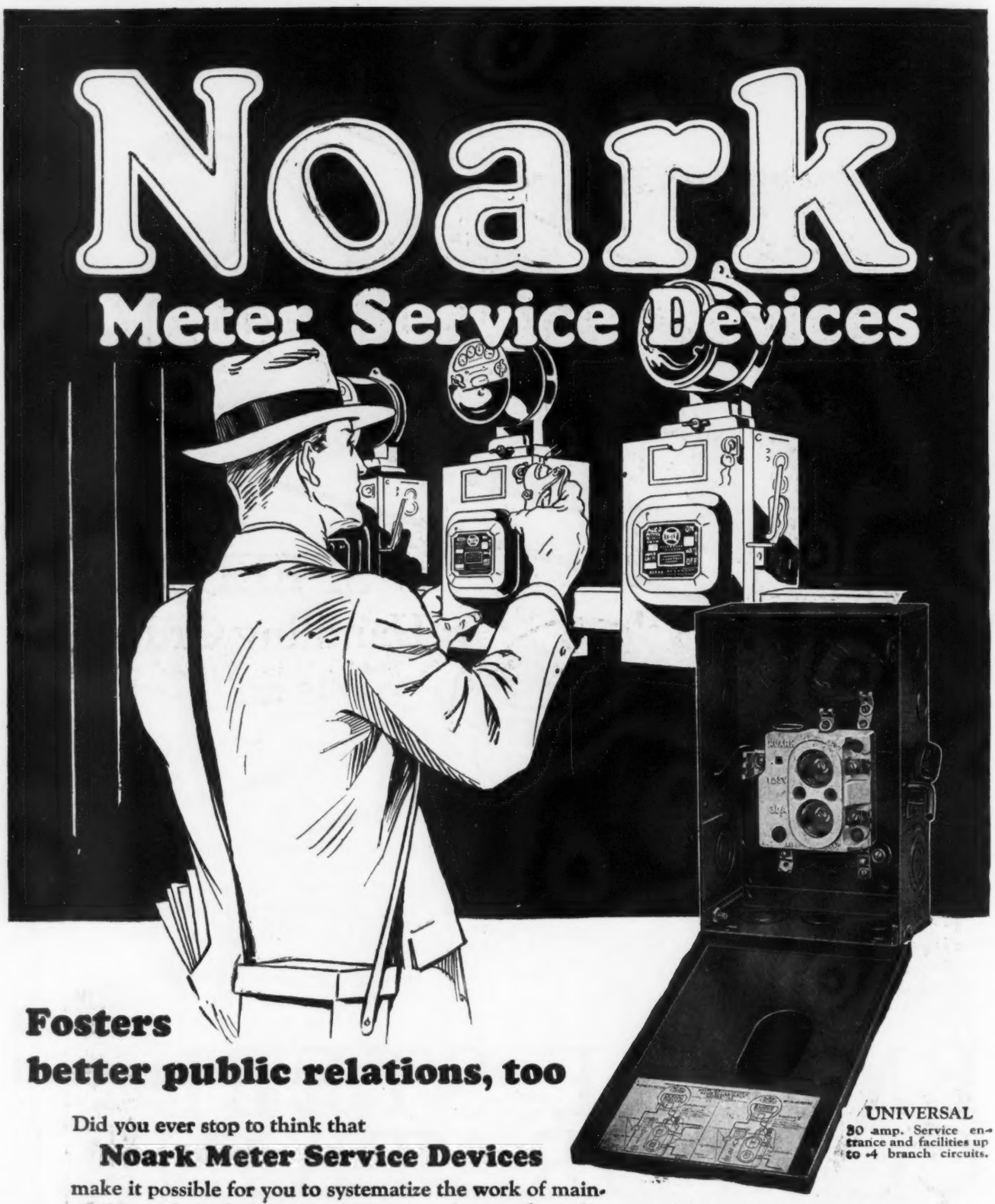
Noark

Meter Service Devices



Fosters better public relations, too

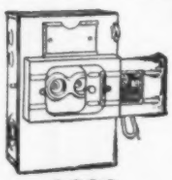
Did you ever stop to think that

Noark Meter Service Devices

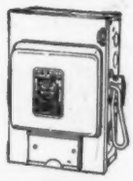
make it possible for you to systematize the work of maintaining and regulating your service to a degree where disputes with your customers are the exception and not the rule?

Whatever your practice in switching, fusing, grounding and sealing, the Noark Meter Service System includes devices which meet them exactly.

Catalog No. 56 on request



ACCO
30-60-100 ampere capacity. Load side fuses accessible.



SECO
30-60-100 ampere capacity. All fuses sealed.

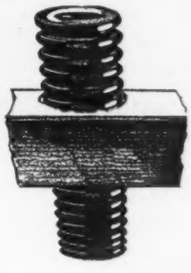
UNIVERSAL
30 amp. Service entrance and facilities up to 4 branch circuits.

COLT'S PATENT FIRE ARMS MFG. CO.
ELECTRICAL DIVISION
HARTFORD, CONNECTICUT, U. S. A.

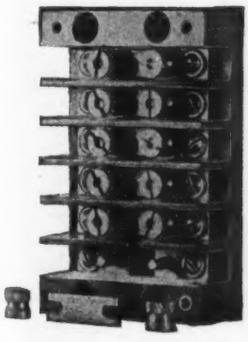
NEW YORK · BOSTON · PHILADELPHIA · PITTSBURGH · CHICAGO · SAN FRANCISCO 23-S-28

ELECTROSE —the weather resisting high tension insulation

Better able to serve you from our new plant—



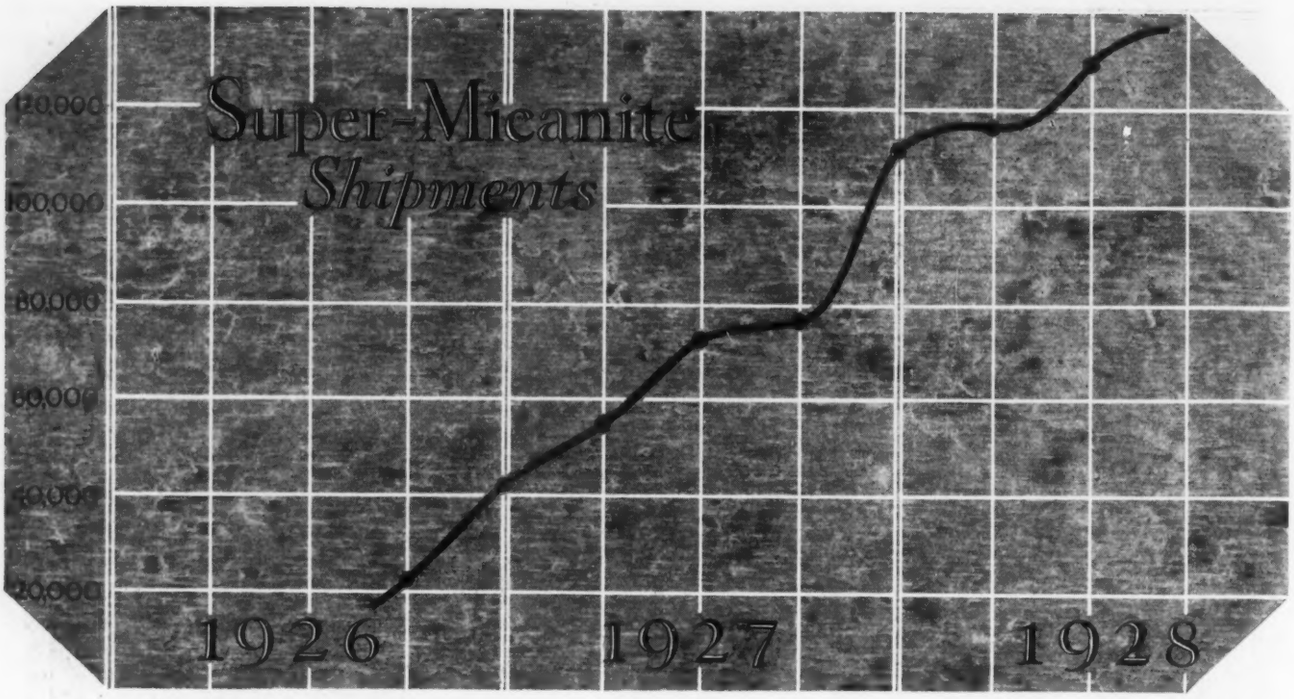
Bigger and better manufacturing facilities enable us to do a better job in serving our customers. A steady increase in business over a period of years is the underlying reason for it all. For this we are grateful to those whom we have served and pleased. This new plant, with its increased facilities, stands ready to supply your demands for "Electrose" "Bakelite" and "Insulate" products. Send us your specifications. Quotations cheerfully and quickly given.



The block at the left was made for use in the East Weymouth station of the Edison Illuminating Co. of Boston. The removable links enable the operator to make his tests quickly and easily. Information on all Electrose products on request.

A new form of terminal block is shown at the right. This is developed to form a larger writing space for noting wire destinations and functions. This feature greatly simplifies testing and repairing. This block is now ready for general distribution in several sizes.

INSULATION MFG. CO., INC.
AND
GENERAL INSULATE CO., Inc.
New York Avenue and Herkimer St., BROOKLYN, N. Y.



Upward goes the curve!

NEW in 1926—firmly established in 1927—sweeping on to dominance in 1928—that briefly is the history of Super-Micanite. It is the story of a better electrical insulation, produced through years of research, performance-proved in thousands of motors, generators and control apparatus of one of the world's largest electrical manufacturers — then offered to the electrical industry.

Because of its outstanding electrical, chemical and physical characteristics, electrical manufacturers and repairmen will accept no substitute for Super-Micanite, after once enjoying its many advantages. Super-Micanite gives more mica per pound of insulation—greater insulating value—does not corrode copper when subjected to excessive heat—and shows practically no slippage under pressure.

Ten of the outstanding practical advantages of this modern electrical insulation and some of its many applications are described in Bulletin 111. Write for a copy—and ask for a sample sheet of Super-Micanite so that you can confirm our claims.

MICA INSULATOR COMPANY

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Works: Schenectady, N.Y. London, England

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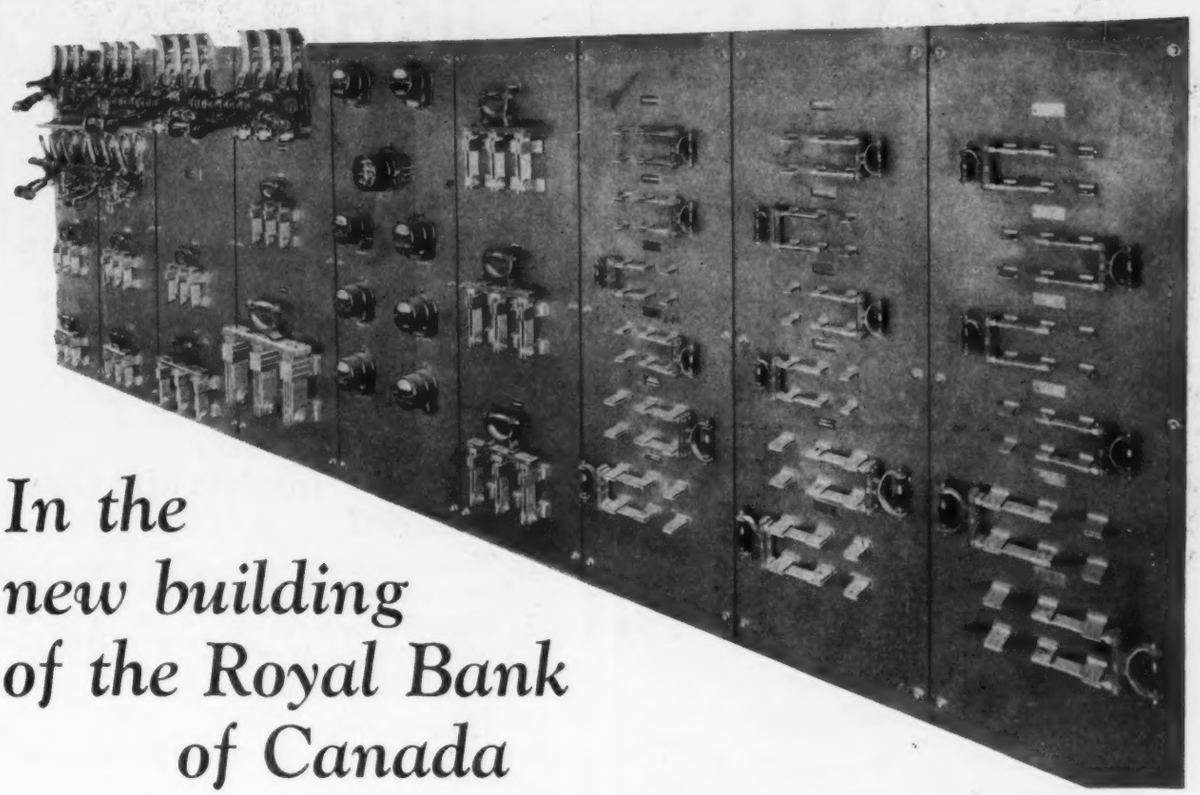
PERFECT MICANITE INSULATOR REG. U.S. PAT. OFF.

Electrical INSULATION

PERFECT EMPIRE INSULATOR REG. U.S. PAT. OFF.

MICA INSULATION OILED CLOTH INSULATION



In the new building of the Royal Bank of Canada

—the tallest building in the British Empire

The switchboard in this building is Portland-Monson Slate, assembled and erected by the Devoe Electric Switch Co., Montreal, Canadian Comstock Co., Contractors. Simply another way of saying that it is a GOOD switchboard, positively PROOF against surface leakage.

The slate is natural finish. Only a thin coating of petroleum oil. Used by the electrical industry for 21 years. During that period not one piece has been rejected because of defective insulation qualities. Uniformly superior quality. Every shipment is steadfastly kept to the highest standard.

Portland-Monson Slate is supplied for every type of Switchboard. Our large facilities assure prompt and error-proof handling of every order. We will be glad to study your needs and present quotations.

PORTLAND-MONSON SLATE CO.
PORTLAND, ME.
Quarries at MONSON, ME.

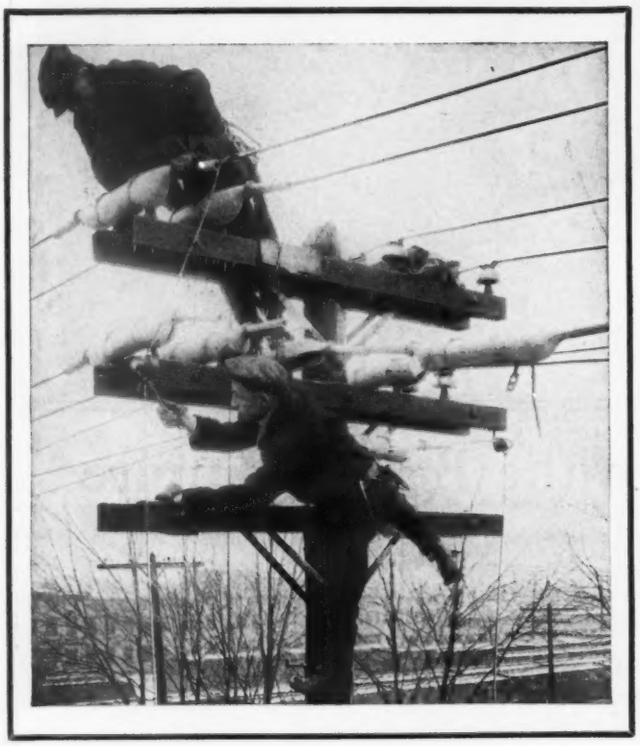
PORTLAND-MONSON SLATE

Switchboards of
NO SURFACE LEAKAGE

AVOID

Costly Service Delays

MARSHALL'S LINEMEN'S SHIELDS



BECAUSE line crews of over a thousand companies are protected by Marshall's Linemen's Shields they work faster. Costly traffic delays and service interruptions are avoided.

For over twenty years Central Stations have recognized the fact that protecting lives and property is good business. That's why they provide their line crews with an ample supply of Marshall's Shields.

Let us tell you about them. Then you'll clearly see the wisdom of their use. Write.

Linemen Protector Co.
2008 Penobscot Bldg., Detroit, Mich.

HEMINGRAY

made in sizes up to 15,000 *volts*

EST. 1848

INC. 1870

For medium voltage lines
Insulate with Glass

Advantages!

(1) Transparency
Exposes internal defects

(2) Non-Porosity
Eliminates Moisture Absorption
Sustains dielectric strength
Prevents deterioration

(3) Homogenity
Insures uniform insulating properties throughout each insulator.

Up to 15,000 standardize on Glass

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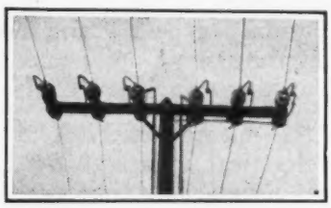

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K-P-F switches are the cheapest and quickest to install.
No special structure is required, simply bolt the switch units to the cross arm and dead-end the line to the insulators, connect the central rod and the switch is ready for service.

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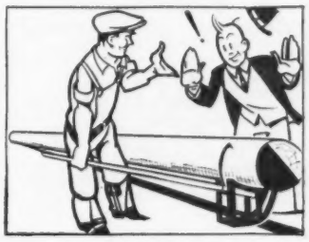

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There is a positive lock in the closed position which requires a disengaging operation before the switch can be pulled through the downward operation. Again there is an entirely independent lock at the 90 deg. or clear position which requires another disengaging operation before the blade can be pulled to the new closed position and automatically locked.

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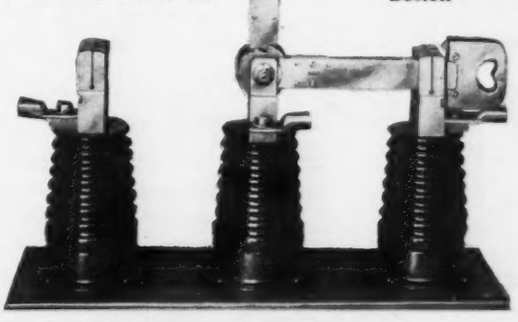

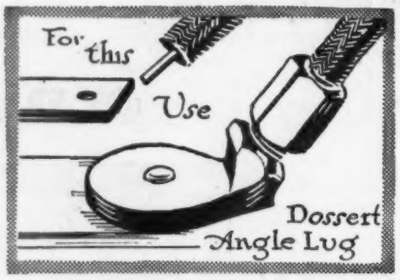

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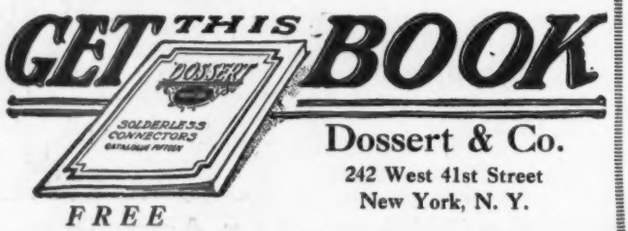

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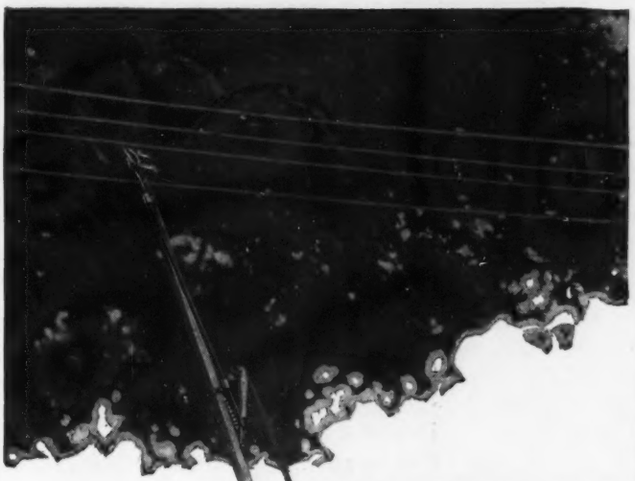

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—and your linemen!

YOU know it's necessary to keep limbs and branches away from your lines—but are your men provided with the best, safest equipment while doing it?

Bartlett Tree Trimmers have a compound lever blade that cuts through 1¼ in. limbs with ease. The pole is of light weight, airplane spruce in 8 to 16 foot lengths, with extra lengths easily attachable and locked with aluminum sleeves. The Bakelite insulator, tested to 105,000 volts, permits the Bartlett Tree Trimmer to be used around hot wires with absolute safety for the lineman.

For limbs larger than 1¼ in. the Bartlett Pole Saw, illustrated at the left is very efficient. It is equipped with 16-in. blade, seven teeth per inch.

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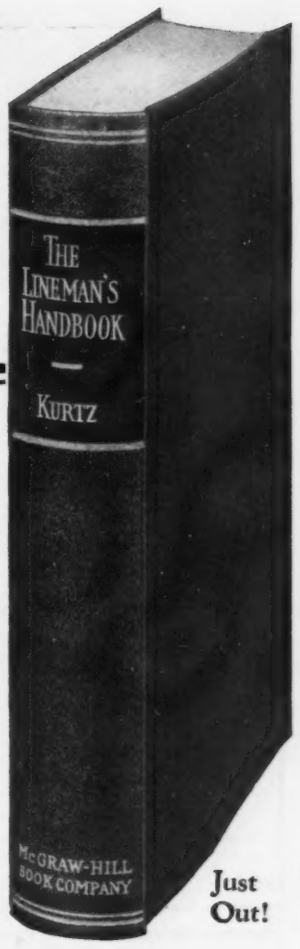
How crack linemen get things done!

HERE is a new pocket book that covers everything the practical man wants to know about every phase of transmission line work; a handy, pocket-size volume packed from cover to cover with workable plans, methods, "kinks," short-cuts, tables, diagrams, and photographs, covering every aspect of materials, poles, towers, stringing, guying, trouble-shooting, first-aid, etc., etc.



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DO YOU want to know about guy materials? This book discusses them completely. Are you interested in quick, workmanlike pole and tower erections? This new handbook tells you, step-by-step just exactly how experienced foremen go about this work. Do you want the latest data on testing, leak locating, trouble-shooting? Wouldn't you like dependable information on every little detail of the lineman's work right at your fingertips for instant reference while on the job? This great book gives you all of these facts and more.

This new book discusses electric fundamentals. It sketches briefly a survey of the electrical system from generation to distribution. It goes fully into distribution circuits, materials and equipment, control, and protective methods and apparatus, the fundamentals of transmission line design, accident prevention, and literally hundreds of facts and figures that every lineman, superintendent, foreman, and employee of the line department wants.

Published July, 1928

The LINEMAN'S HANDBOOK

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Member, A.I.E.E.; Professor of Electrical Engineering and Head of Department, Oklahoma Agricultural and Mechanical College; formerly Member of the Educational Department, Milwaukee Electric Railway and Light Company.

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There are no annoying technicalities. Everything is plain and practical—usable and up-to-the-minute.

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—why is a ground wire mounted above the other conductors in a given line?
—how deep should a pole-hole be made?
—which is the better method of pole-erection? The piking method or by means of a ginpole?
—what is a blackwall hitch?
—what instrument is used in order to determine the correct tension?
—how would you proceed to make an armoured Western Union tie?
—what is the correct procedure in changing a suspension-type insulator on a live line?
—when should climbers not be used?
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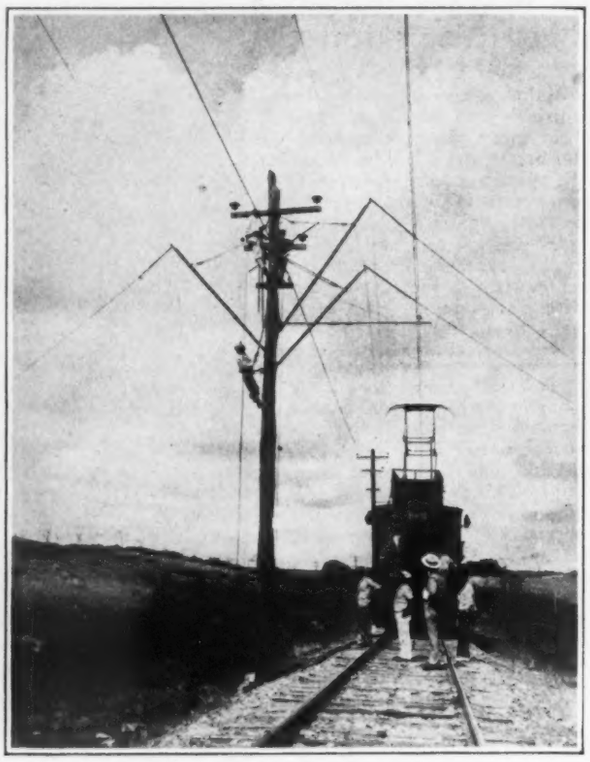

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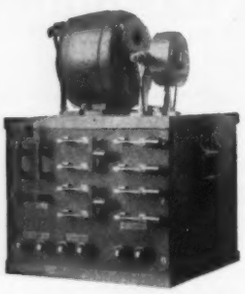

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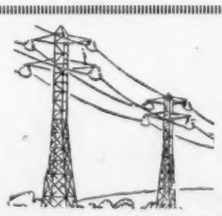

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We have the most modern equipment to do first class galvanizing at lowest prices. Send prints.
Galvanized products furnished.
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SAVING ITS OWN COST. On its first job this electric is doing the work—and saving the expense —of a boat-dredge.

Paid for itself on its first job!

Read about this unusual adaptation of electric trucks in maintaining public service

AN electric truck as a channel dredge! There's an example of the adaptability of electrics for you!

Yet that is just what the truck in the picture did. Its very first job was dredging a trough for the land connection of a submarine cable. And this electric did its work so well that the cost of hiring a boat-dredge was saved—*a saving which more than covered the original cost of the truck.*

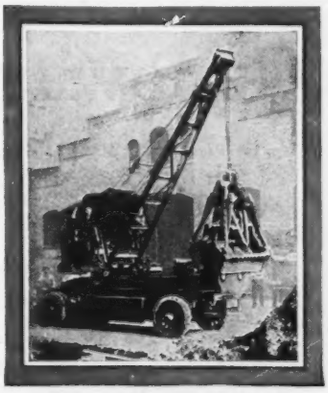
This is only one of the many ways in which electrics are helping to maintain public service. And whatever work they are set to do, the electrics handle it *more efficiently and economically than it was ever handled before.*

This is especially true if the battery that drives the truck has four qualities: (1) high power ability, (2) sustained speed, (3) low charging cost and (4) long life—qualities which are the outstanding characteristics of the Exide-Ironclad Battery.

Try this combination—an electric powered with an Exide-Ironclad Battery—on your own short-run work. Other public service companies are saving money with it. You can, too.

SEVEN ADVANTAGES OF ELECTRIC TRUCKS

1. *Plenty of speed*
2. *Ease of operation*
3. *Ten to fifteen year life*
4. *Power to haul extra-heavy loads*
5. *Daily coverage of 30 to 45 miles*
6. *Surprisingly low operating cost*
7. *Absolute dependability under all weather conditions*



NOT SO BIG—but this electric with its portable dredge is saving lots of money for its owners.

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IRONCLAD
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THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia

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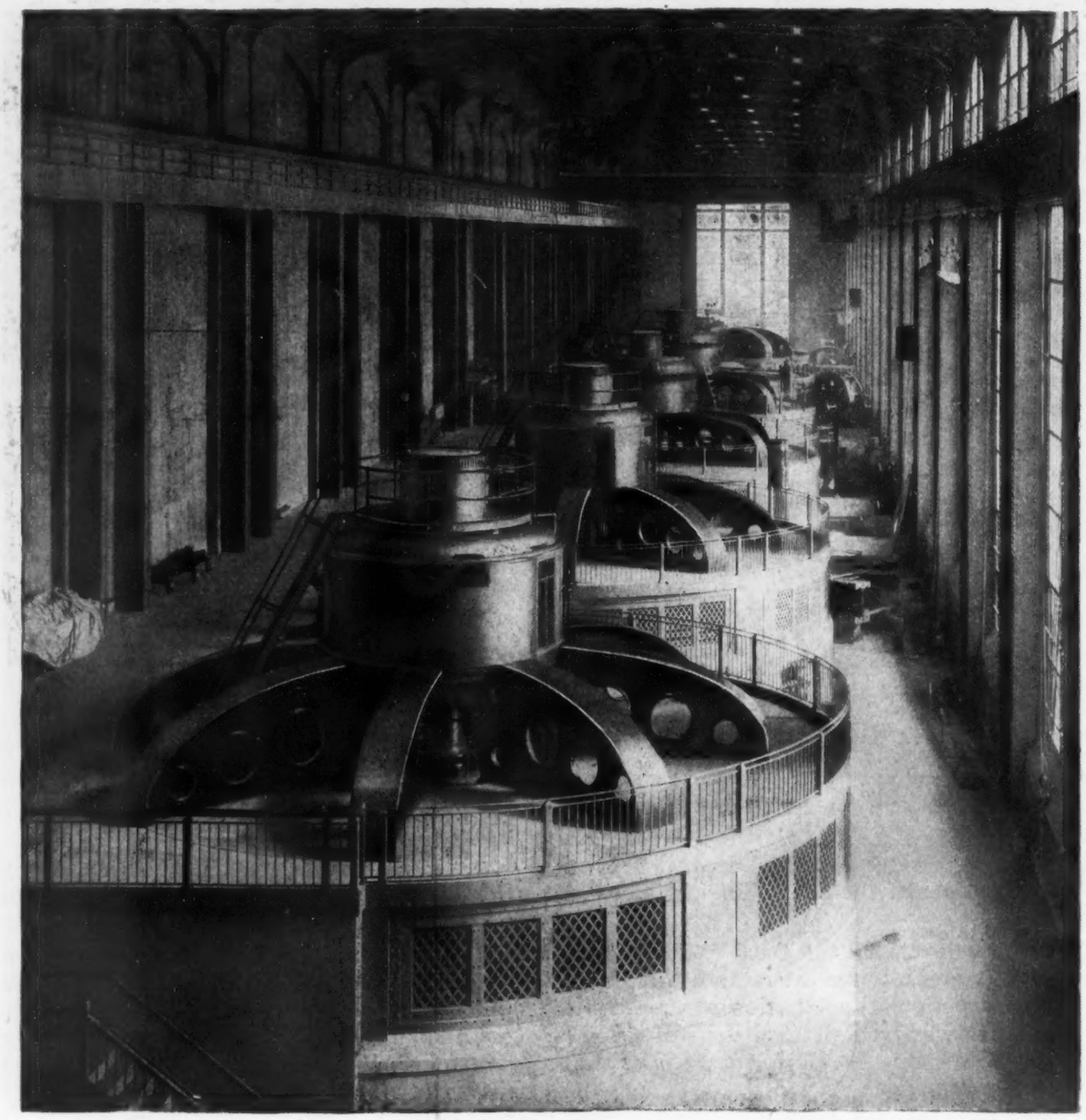

View during construction showing four of the seven generators in place. Two of the four G-E generators are in the foreground.

The Conowingo Generators

On March 1st—three months ahead of schedule—two of the four G-E 40,000-kv-a. waterwheel-driven generators manufactured for the Conowingo plant of The Philadelphia Electric Company were placed in operation. The two remaining General Electric units have since been installed and are now in operation. These four 40,000 kv-a. generators embody radically new features, including welded and fabricated steel construction, characteristic of the present-day G-E practice.

Total capacity installed, 6,500,000 kv-a.
Sizes built range from 30 to 65,000 kv-a.

100-12

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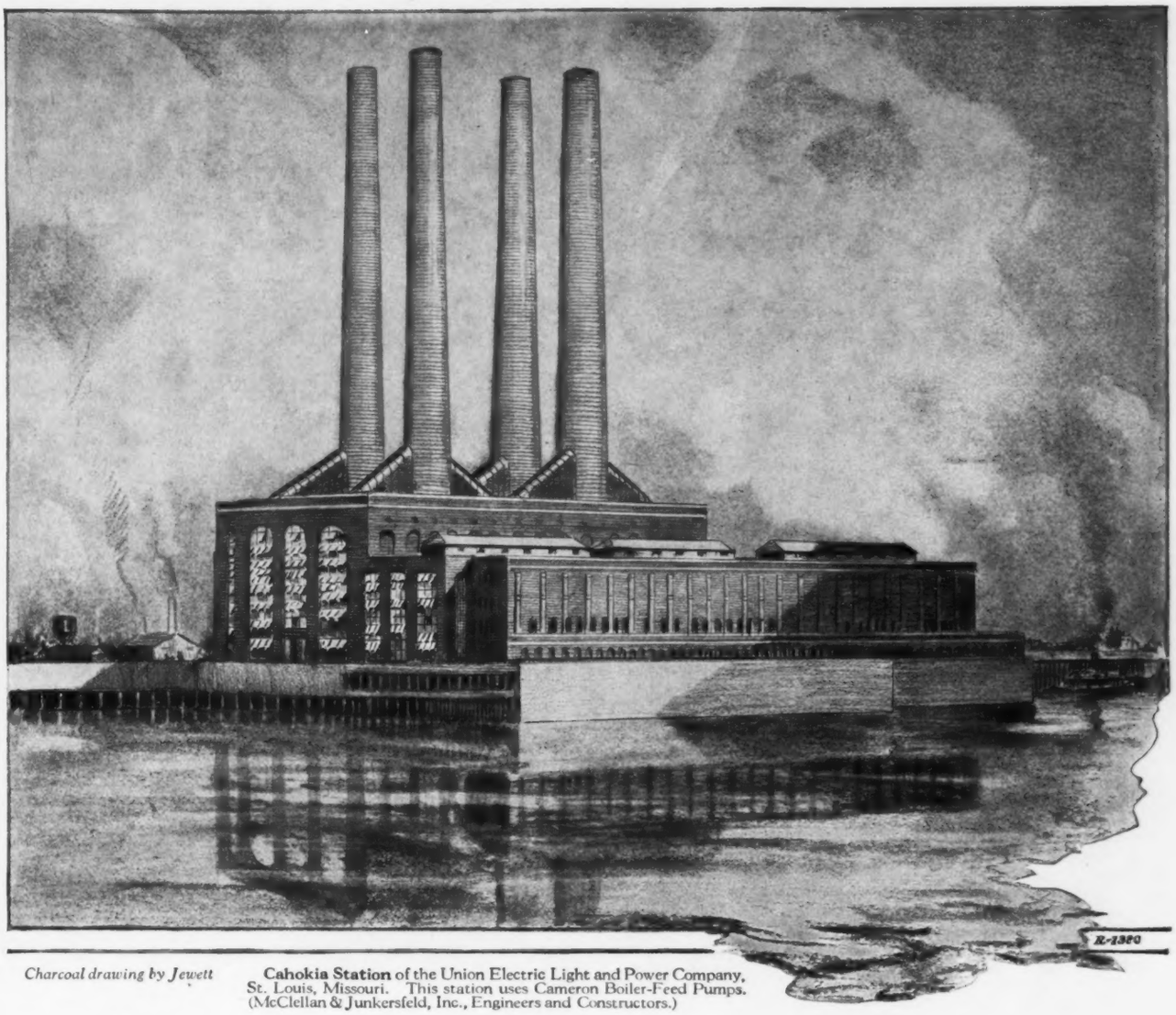
GENERAL ELECTRIC COMPANY, SCHENECTADY, N. Y., SALES OFFICES IN PRINCIPAL CITIES



Charcoal drawing by Jewett

Cahokia Station of the Union Electric Light and Power Company, St. Louis, Missouri. This station uses Cameron Boiler-Feed Pumps. (McClellan & Junkersfeld, Inc., Engineers and Constructors.)

another~

Central Station with Ingersoll-Rand and Cameron Equipment

Cahokia was the second large central station to adopt pulverized coal, and was a pioneer in applying this method of firing to low-grade fuel.

This station is located on the east side of the Mississippi River just south of the East St. Louis limits. This station when completed will have four sections. Each section will contain two turbo-generator units and eight boilers in separate units to permit taking advantage of the advance in the art of design in future sections. Two sections are already complete. Turbo-generators Nos. 1, 2, and 3 have ratings of 35,000 kw. each; No. 4 has a rating of 40,000 kw., making a total present capacity of 145,000 kw.

Steam conditions of 350 lbs. gauge and 725° F. are used, but no economizers, filters, chemical treatment, or devaporizers are employed.

Ingersoll-Rand and Cameron Equipment for the Central Stations:

Surface Condensers
Boiler-Feed Pumps
Circulating Pumps
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Service Pumps
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A. S. CAMERON STEAM PUMP WORKS

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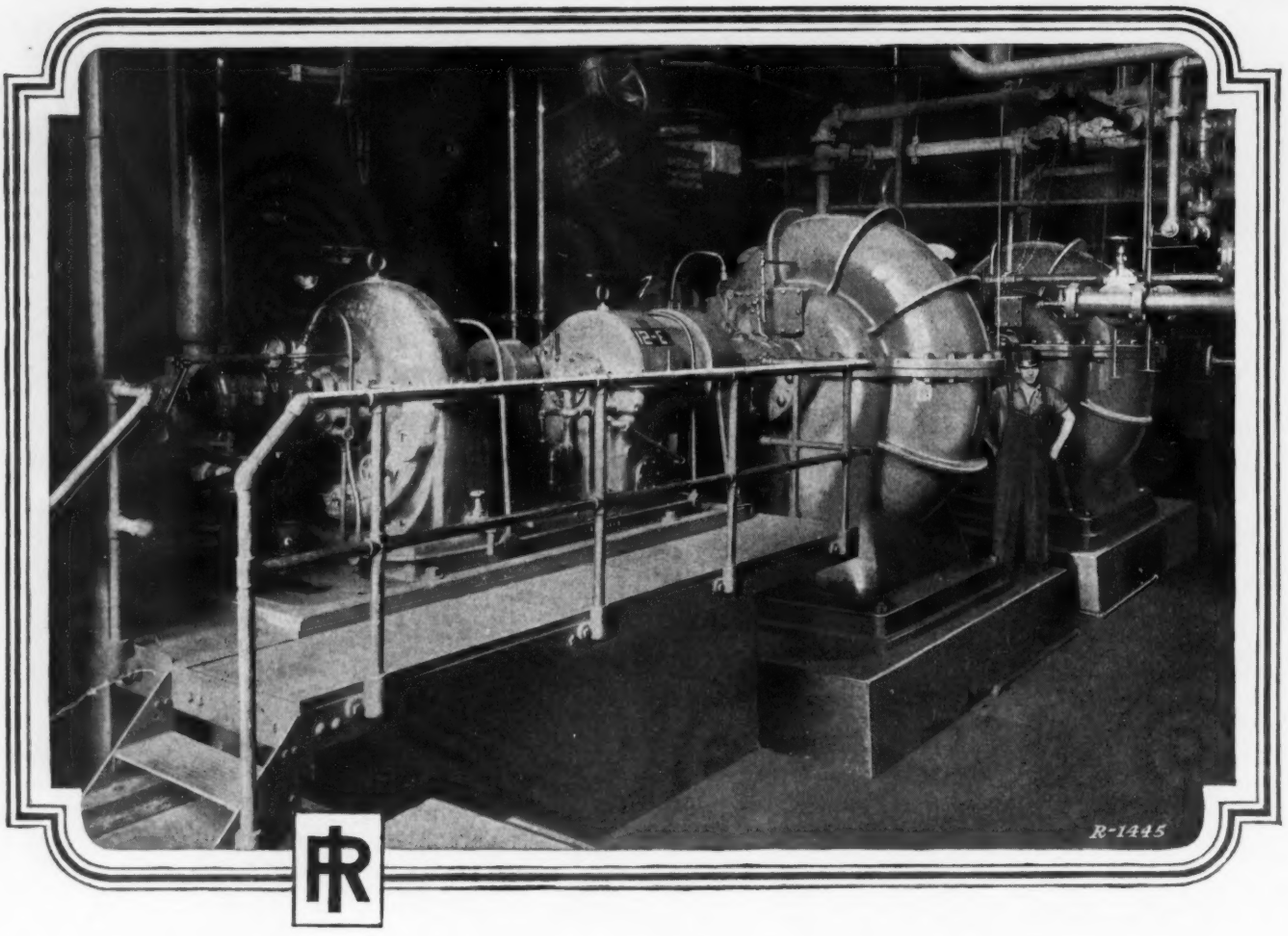

For the Central Stations Cameron Offers:

The FV Circulating Water Pump. This unit is built in a single stage for capacities as high as 80,000 g.p.m. and for heads up to 175 feet. It may be driven by electric motor or steam turbine. It is a highly dependable and efficient pump.

The HMT Boiler-Feed Pump. This unit is built in two to six stages and for electric motor or steam turbine drive. The pump is particularly adapted to high-capacity and high-pressure boiler feeding. Many of the modern stations are operating these units with exceptional economy.

The HW Condensate Pump This unit is built in two stages for capacities up to 1,600 g.p.m. and for total heads of 240 feet. It may be driven by either electric motor or steam turbine. The unusually high efficiency of this pump on hot-well duty has proved attractive to many central station engineers.

The LV General Service Pump. This unit is built in a single stage for capacities up to 2,500 g.p.m. and for heads up to 231 feet. It is driven by electric motor or by steam turbine. This pump is efficient and reliable, and proves a popular unit for any general pumping duty.

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A. S. CAMERON STEAM PUMP WORKS

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CUT PLANT COSTS
Before a wheel turns-with the
Taylor Stoker

One of the greatest reasons for the employment of Taylor Stokers in the world's important utility and industrial plants, is the remarkable economy in plant layout which results from their selection.

The chief factors entering into steam plant costs are, briefly: Boiler space; space devoted to the combustion system; cost of boilers; cost of plant building.

The Taylor Stoker, because of its extremely high rate of combustion, reduces these costs in this order:

Fewer boilers.

Smaller boiler-furnace units, because of the high rates of heat release per cubic foot of furnace volume.

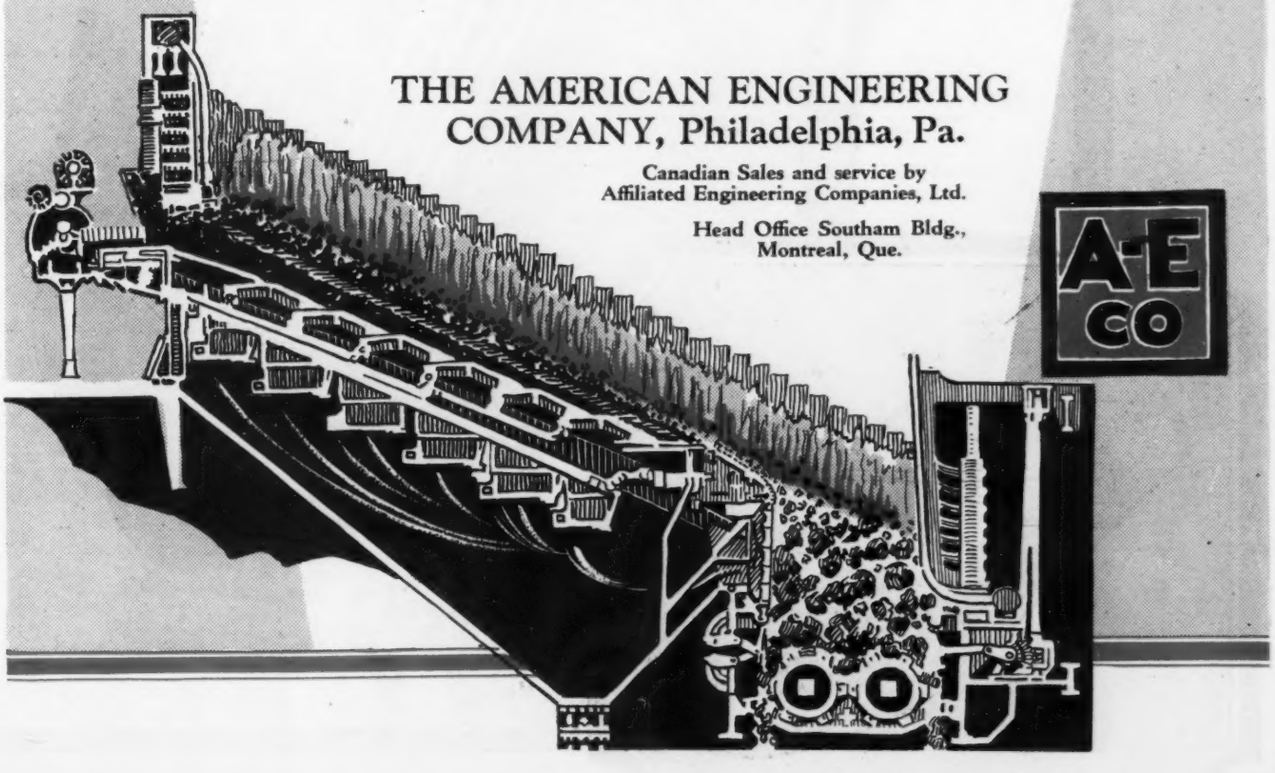
Economy in space required for stoker accessories, since the Taylor Stoker is a compact self-contained unit and the driving turbines or motors can be mounted directly on the stoker power boxes, or be placed at any convenient location.

Simplified plant layout, because the high capacity of the Taylor Stoker (up to 700,000 lbs. of steam an hour) makes it practicable to use a single Taylor unit to each generator.

Low building costs, because of the comparatively small space required for the desired capacity.

These economies result in an important saving in fixed charges alone—before the operating economies and low maintenance charges of the Taylor Stoker are even considered.

Write for further information.



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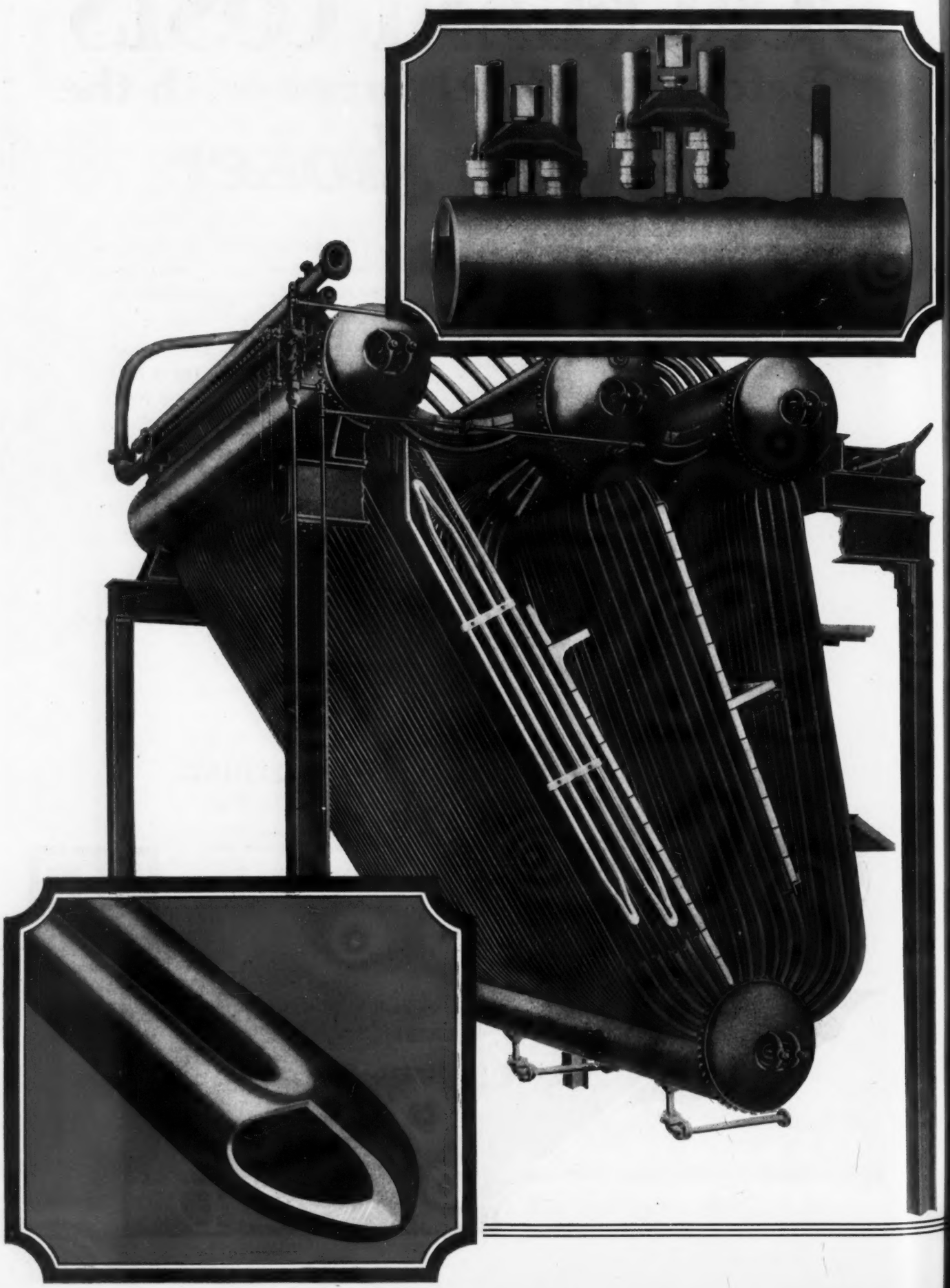


Your Superheater

How DESIGN *aids construction*

Eventual results from any superheater is determined by its design. If the basic design is clumsy, the installation is clumsy and the results must be achieved in clumsy fashion. In keeping with the editorial text of this issue it is fitting to show the manner in which the Elesco superheater covers these important points.

The Elesco design is predicated on two exclusive features— both illustrated at the left.

(*a*) The Elesco ball joint

(*b*) The Elesco forged return bend

How CONSTRUCTION *aids installation*

Consider for a moment the construction of these features.

To form the ball-shaped ends on Elesco units, the ends of the tubes are subjected to an upsetting process— then faced in a lathe and ground to form true parts of a sphere.

Conical seats are ground in the header so that each ball end will have a line contact at the center of the 45-degree face.

The units are clamped in place, with the holding strain on high tensile strength studs.

The forged return bends, which form the loops of the units, are forged out of the metal of the tubing by a mechanical die-forging process. Units so formed are homogeneous and as strong as the tubing from which they are made— in fact the thickness of the metal is increased at the bend so that it is stronger than the straight tubing.

Thus, multiple-loop units are formed of any length— to exactly fit the boiler arrangement. The ball joint permits each unit to be easily and quickly attached to the header— simplifying installation.

How INSTALLATION *aids economy*

To illustrate how these features effect economy in power plant construction an Elesco installation designed to handle 400,000 lb. steam per hour was installed in one working day— 120 superheater units.

The Elesco forged return bend and the ball joint permit a type of construction that is factory-built complete, ready for installation in any make or type of boiler.

There is no cutting or fitting— all joints are metal-to-metal and installation is merely a matter of clamping it in place. There are fewer joints to be made and each joint is accessible.

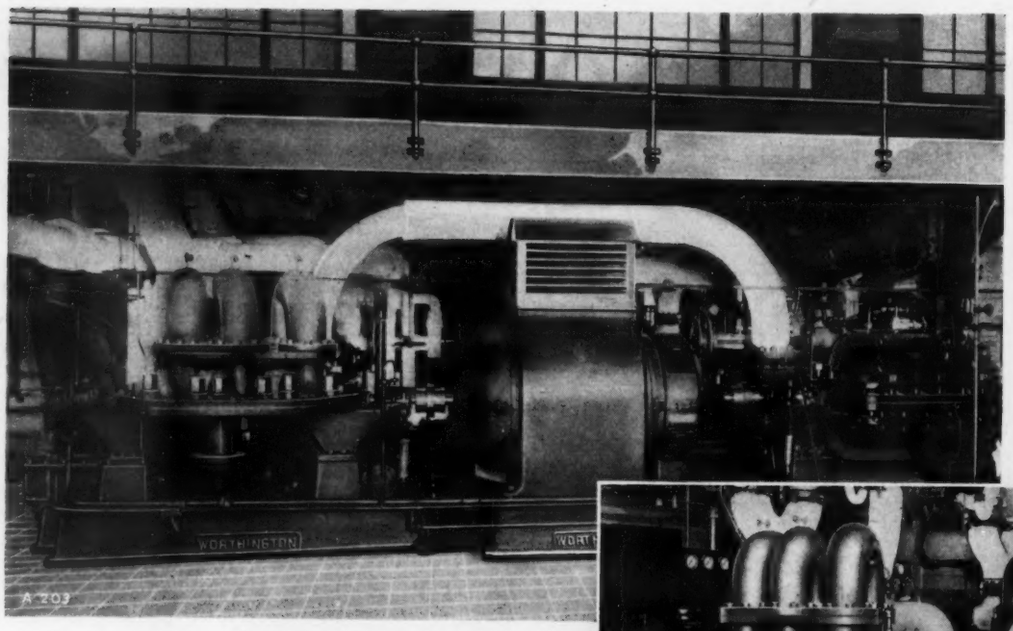
Economy of installation afforded by the Elesco design, as here discussed, is indicative of many inherent features of Elesco superheaters. These are fully covered in a new book illustrating more than 60 superheater and boiler arrangements.

A copy sent gratis on your request.

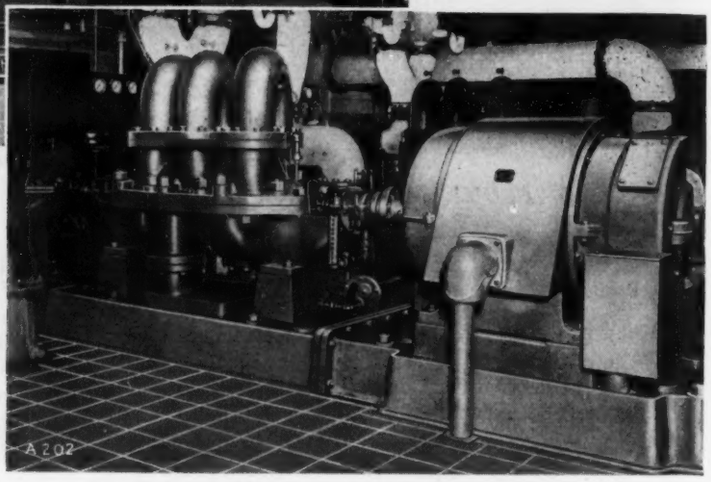
THE SUPERHEATER COMPANY

17 East 42nd St., New York

Peoples Gas Building, CHICAGO — ELESCO — Union Trust Building, PITTSBURGH



Worthington Primary Centrifugal Boiler-feed Pump, (in the inset below) driven by 650-hp. electric motor delivers 1600 g.p.m. against a pressure of 500 lb. per sq. in. The Worthington Secondary centrifugal boiler-feed Pump, (left), driven by a 2030-hp. motor, delivers 2000 g.p.m. against a pressure of 1600 lb. per sq. in.



Main Boiler-feed Pumps . . . . Edgar Station Weymouth, Mass.

HERE are the Worthington Main Pumps that are used *continuously* to feed the boilers at the Edgar Station, Weymouth, Mass., of the Edison Electric Illuminating Company of Boston. This installation, and many others of similar type justify the confidence placed in Worthington equipment for all difficult pumping problems.

WORTHINGTON

PRODUCTS

PUMPS
COMPRESSORS
CONDENSERS
and Auxiliaries
OIL *and* GAS ENGINES
FEEDWATER HEATERS
WATER *and* OIL METERS
Literature on Request

WORTHINGTON PUMP AND MACHINERY CORPORATION, 2 PARK AVENUE, NEW YORK · DISTRICT OFFICES IN 24 CITIES

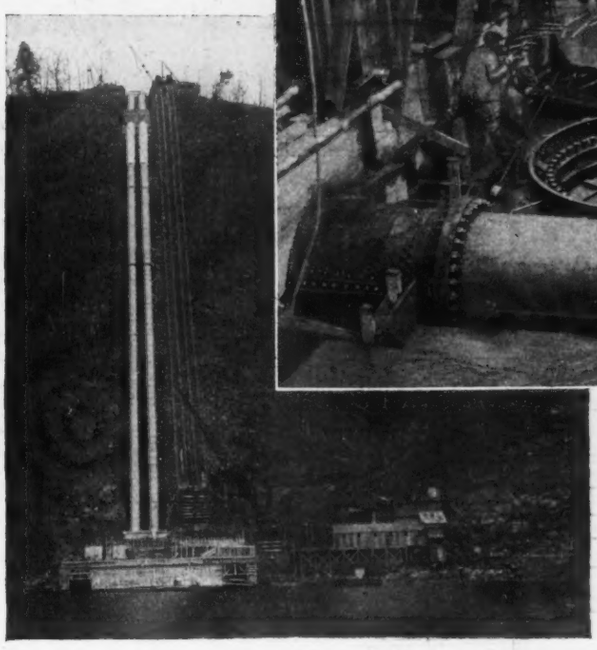
WORTHINGTON

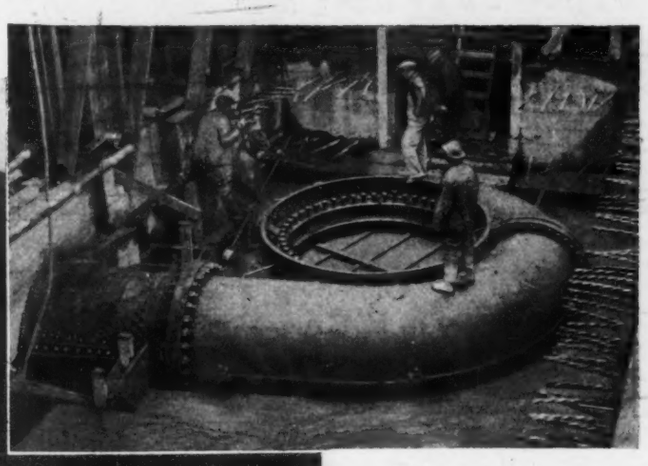
6641-14

SMITH HYDRAULIC TURBINES

AT THE SANTEETLAH DEVELOPMENT of the TALLASSEE POWER CO., Near Calderwood, Tenn.

Two 33,000 H. P. Vertical Smith Turbine Units in cast steel scroll cases are now in successful operation under 660 feet head.





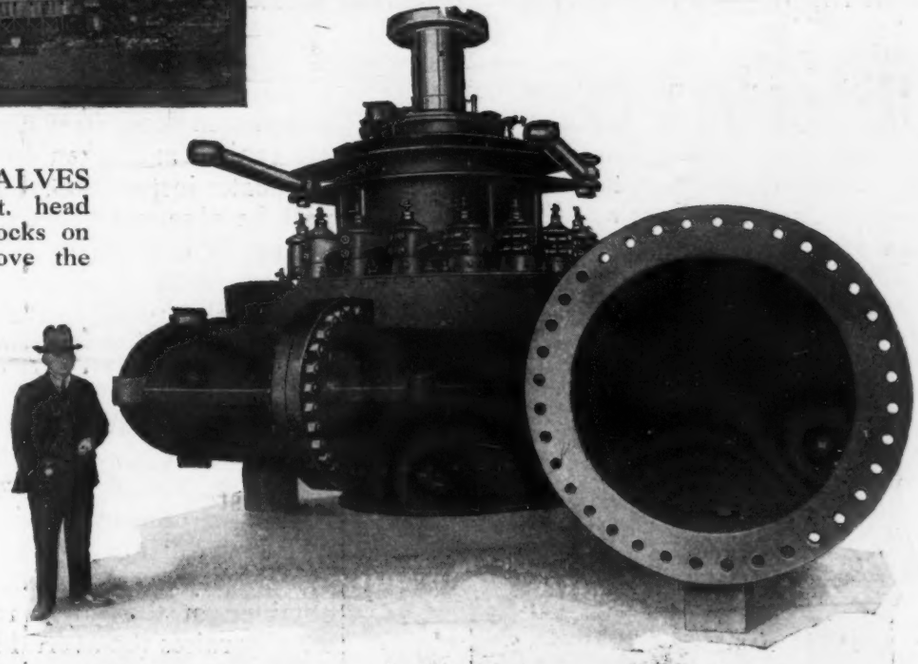
These are the highest head reaction turbines now operating east of the Rockies. However, we are now building two units for the Waterville Development of the Carolina Pr. & Lt. Co., which will each develop 49,000 H. P. under 755 feet normal head with a maximum head of 840 feet.

Views above show the cast steel scroll cases being placed in the power house and a general view of the plant from across the lake during construction.

Two 96 in. DOW VALVES operating under 175 ft. head are placed in the penstocks on the top of the hill above the power house.

Accompanying view shows one unit completely assembled in the shop before shipment.

If interested in Water Power Equipment write our Dept. "H"



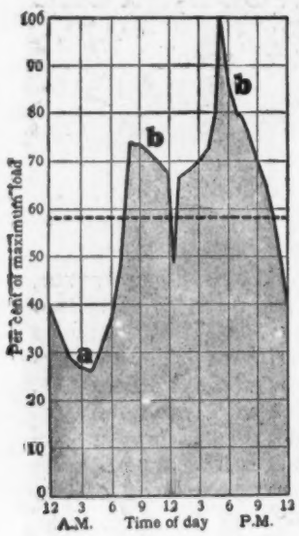
More than 5,782,832 Total Horse Power delivered by Smith Turbines built or now under construction.

San Francisco, 461 Market St.

Salt Lake City, 206 S. W. Temple St. Portland, Ore., 224 Pine St.

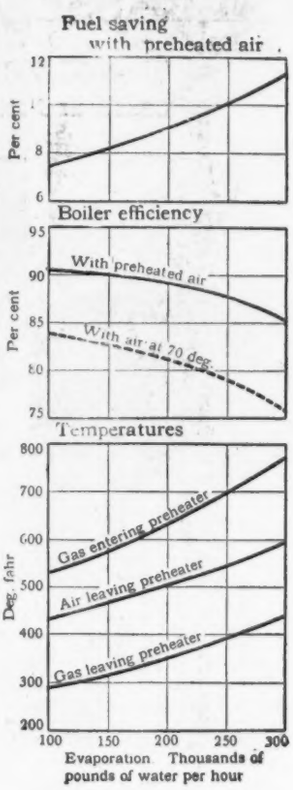
S. MORGAN SMITH CO.—YORK, PA.

Every minute of the day
preheated combustion air does good work

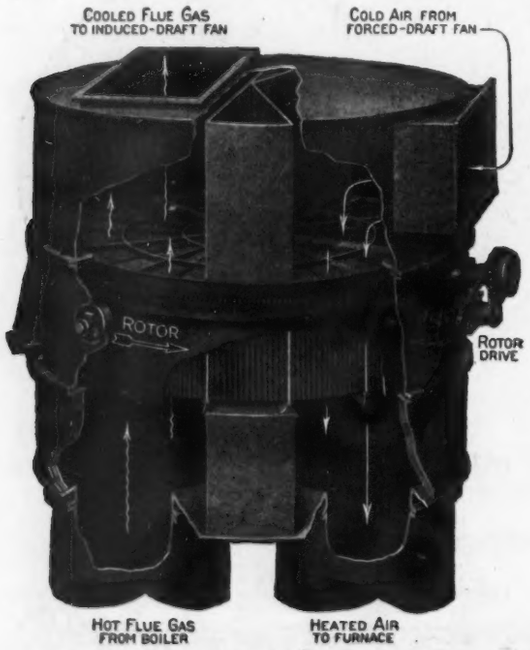


a. ***At light to average loads,*** *return of 70 per cent of the otherwise wasted stack heat to the furnace by using it to preheat the combustion air, does as much additional useful work as though the recovered heat were obtained from an equivalent additional amount of fuel. Under these loads an adequate steaming rate can be maintained with 10 to 14 per cent less raw fuel.*

b. ***At heavy loads and peaks,*** *the 10 to 15 per cent higher steaming capacity is as dependably produced for extended or short periods as though the number of boilers were increased. This is accomplished at only a small fraction of the investment which would be required for additional boilers and fuel-burning equipment that would do the same additional work.*



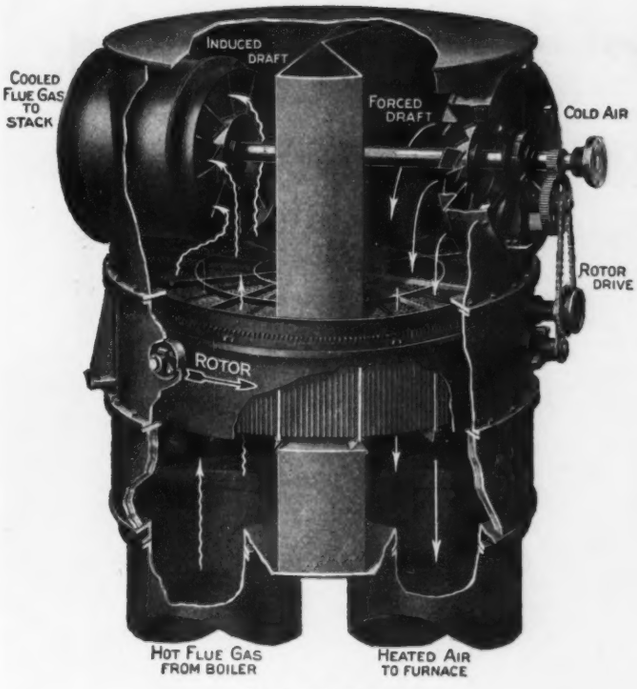
THE gain from preheated combustion air as accomplished at the various boiler forcing rates and by the 70 per cent recovery obtained with the *Ljungström Continuous Regenerative Counterflow Principle* is clearly shown in the accompanying operating characteristics curves which are typical and taken from an actual Ljungström Preheater installation. (Name on application.) It will be observed from these curves that the fuel saving, boiler efficiency increase and degree of preheat in the combustion air are all substantial even while operating light, and that these benefits are also *greater* at the higher ratings at which they are most needed.



Independent-fan type. Fans of any make may be used

While boilers are being forced the hardest, the stack gas temperatures are the highest, but *also,* a *higher* degree of heat recovery is then obtained with the Ljungström Air Preheater. This higher recovery during forcing makes the overall efficiency very nearly as good at high ratings as that obtained at the lower ratings, and thereby materially raises the overall station economy.

As fixed, maintenance and operating charges for a Ljungström Air Preheater do not exceed one-fourth to one-third the value of the fuel saved and the improvement effected, *the net annual return on the preheater investment is extremely attractive to any plant operating under high or moderate load factor.*



Integral-fan type

Only with the Ljungström Continuous Regenerative Counterflow Principle can 70 per cent heat recovery be obtained from apparatus of the small size, weight and cost that make installation easy and assure decidedly the biggest net annual money return on the preheater investment.

Our Engineers will prove these statements and make you performance and net return guarantees that you cannot get with any recuperative type preheater.

The Ljungström is the only universally used Air Preheater—Over 750,000 hp. in service in the U. S. A.

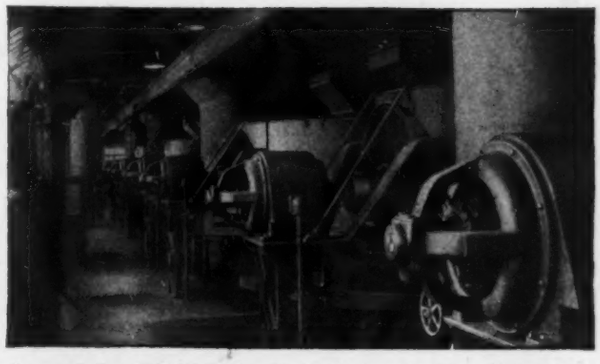
THE AIR PREHEATER CORPORATION

25 Broadway, New York

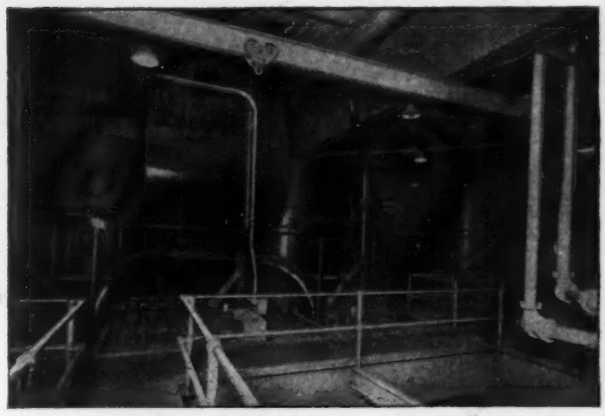
Works: Wellsville, N. Y.; Agents in

Boston	Philadelphia	Pittsburgh
Buffalo	Cleveland	Cincinnati
Chicago	Minneapolis	Kansas City
Charlotte	St. Louis	Houston
Denver	New Orleans	Los Angeles
		San Francisco

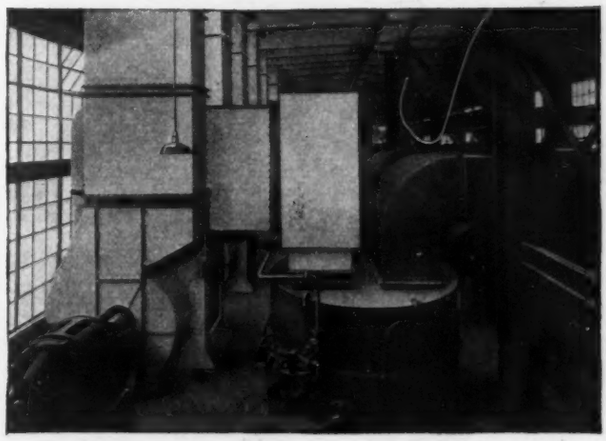
Canadian Licensees: Lammers & Maase, Ltd.
1075 Beaver Hall Hill, Montreal



Some of the 16 Ljungström Air Preheaters that have helped the 90,000-kw. Stanton Station at West Pittston, Pa., to show record efficiency and fuel rate. This is one of the world's largest installations of regenerative air preheaters and is sensationally successful.



At Bayside Station of Wisconsin Public Service Corporation, four Ljungström Air Preheaters recover heat from the exit gases of two boilers, each having 13,400 sq.ft. of heating surface.



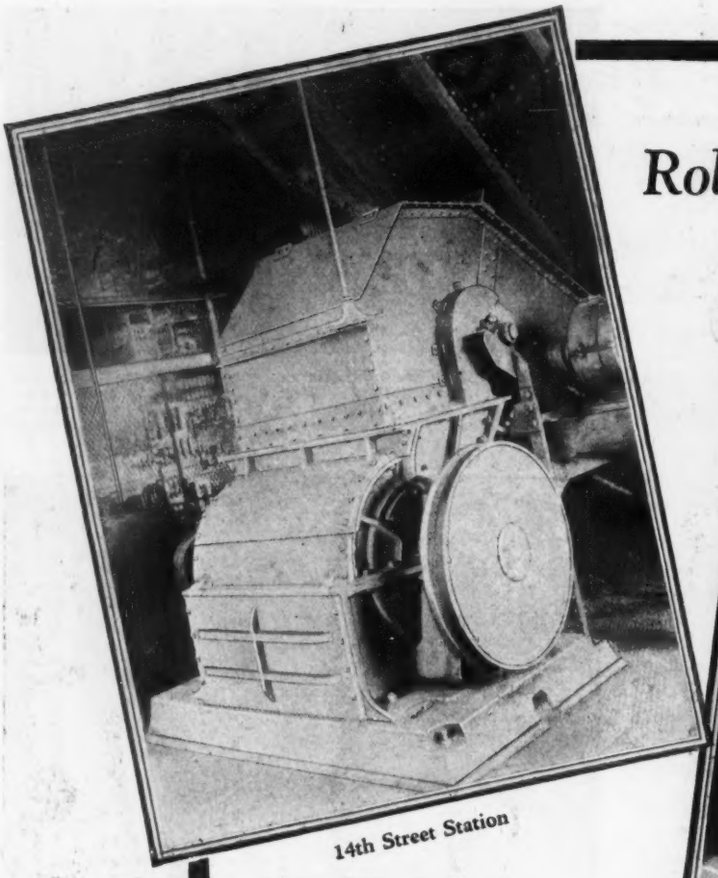
Ljungström Independent-fan Type Air Preheaters serving three 1500-hp. oil-fired boilers in one of the largest power and lighting plants in the South.

Ljungström AIR PREHEATER

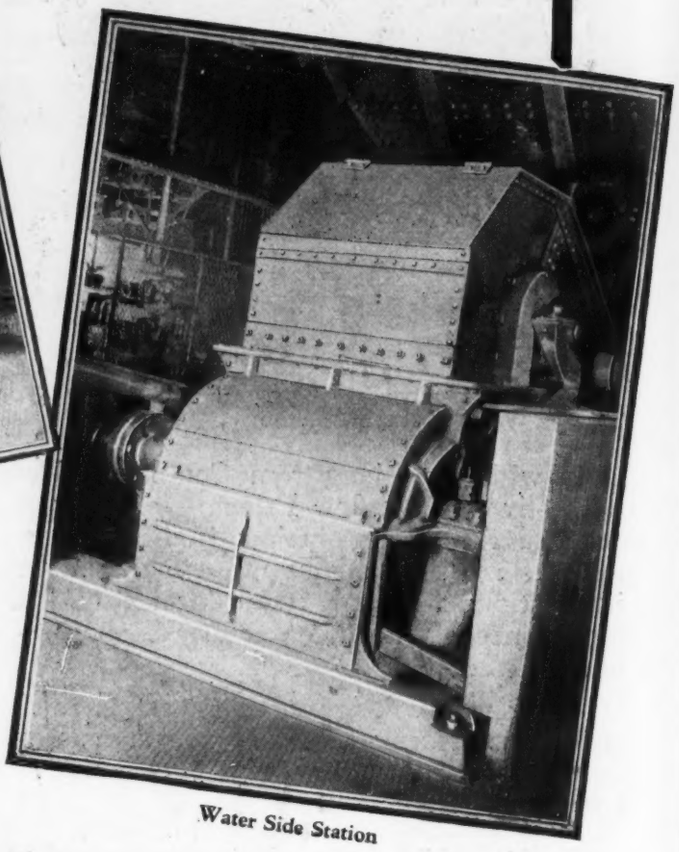
REG. U.S. PAT. OFF.

CONTINUOUS REGENERATIVE COUNTERFLOW

Two American *Rolling Ring Crusher* *installations of the* New York Edison Co.



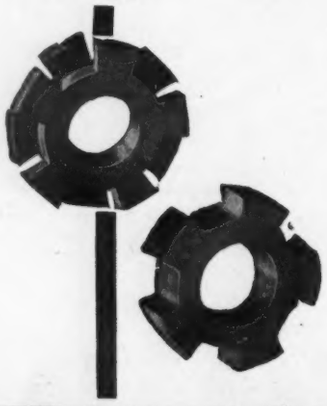
14th Street Station



Water Side Station

These No. 42 American Rolling Ring Crushers are each sizing about 350 tons per hour.

Fuel economy begins at the crusher



Coal crushing in your own power plant is economical in direct proportion to the efficiency of your crusher both on the basis of fuel costs and the efficiency with which it is burned in your boilers.

American Rolling Ring Crushers, with their low operation cost, due to many improved mechanical features, leave you the full saving made possible when you buy run of mine coal.

In preparing coal that will burn most efficiently in your boilers the American *Rolling Ring* principle of crushing offers a range of sizes to meet your requirement. It produces a fuel well within the limits required for maximum efficiency in your boilers.

American Ring Crushers have produced properly sized fuel from R.O.M. coal at less than 2c. per ton. This cost includes labor, power, upkeep, depreciation and interest on investment.

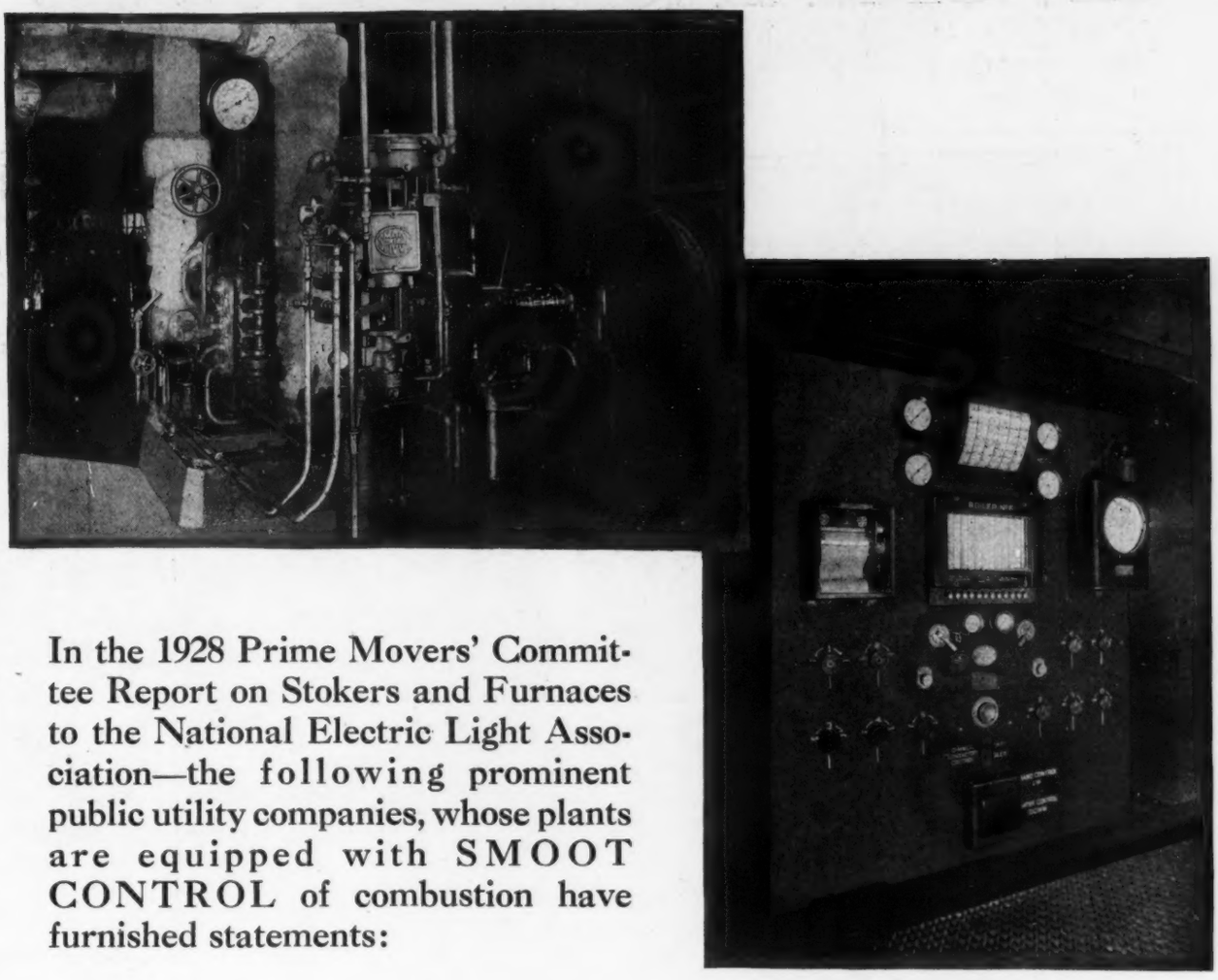
Write for further detail information and surveys.

ORIGINATORS OF THE ROLLING RING CRUSHER PRINCIPLE

AMERICAN PULVERIZER CO

1249 MACKLIND AVE · ST·LOUIS·MISSOURI

SMOOT CONTROL



In the 1928 Prime Movers' Committee Report on Stokers and Furnaces to the National Electric Light Association—the following prominent public utility companies, whose plants are equipped with SMOOT CONTROL of combustion have furnished statements:

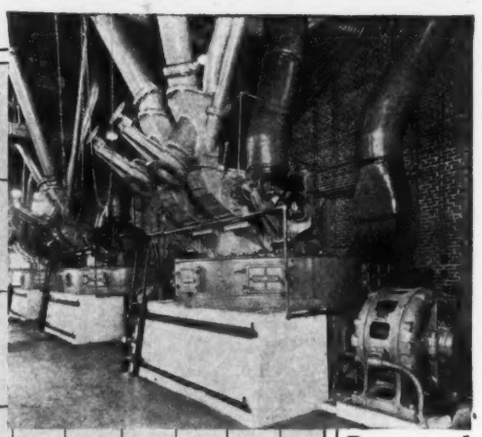
Brooklyn Edison Company
Comal Power Company
Detroit Edison Company
Florida Power & Light Company
Narragansett Electric Lighting Company
United Electric Light & Power Company
Toledo Edison Company

Five of these companies have given repeat orders for SMOOT CONTROL of combustion because their own experience has proved it to be economically indispensable.

SMOOT ENGINEERING CORPORATION

136 Liberty Street **New York**

Pulverized



Raymond Super-Mills installed in a large central station of the southwest.

FROM 600 LBS. TO 60,000 LBS. GROUND PER HOUR

Raymond Impact Mill installed in the power plant of a nursery company in the middle west.

COMBUSTION

FUEL

RAYMOND SUPER-MILLS of the type shown on the opposite page have a pulverizing capacity of 60,000 lbs. of coal per hour per unit. The small Raymond Impact Mill shown below is rated at 600 lbs. per hour. These extremes in mill capacity make Lopulco Pulverized Fuel Systems, of which Raymond Mills are an important part, equally adaptable to the requirements of the largest central station and the modest industrial plant.

A pulverized Fuel System, to be successful must be exactly what the term "System" implies—

A properly designed combination and arrangement of component parts functioning as a complete unit.

A good mill, although an important detail, is not sufficient—pulverization is only the first step in pulverized coal firing. Burner design and Furnace design are important. But the Lopulco Systems for burning pulverized fuel represent the complete development of the factor most essential—the grouping of all the individual elements into one complete, properly balanced unit.

Lopulco fired boilers range in capacity from 150 h. p. to gigantic units capable of producing a million pounds of steam per hour.

In total boiler horse power equipped, size of units and operating results—Lopulco leadership remains unchallenged.

COMBUSTION ENGINEERING CORPORATION

International Combustion Building 200 Madison Ave., New York

A Subsidiary of

INTERNATIONAL COMBUSTION ENGINEERING CORPORATION

POWER PLANTS

From 70 H. P. to 1,000,000 KW. ult.

BOILERS

From 70 to over 4,000 rated boiler H. P.

PULVERIZED FUEL ✓

Complete systems with Mill capacities from 600 to 60,000 lbs. of coal per hour.

STOKERS

For capacities from 250 to 40,000 lbs. of coal per hour.

WATER COOLED FURNACES

From 90 sq. ft. to 4,132 sq. ft. of water wall surface.

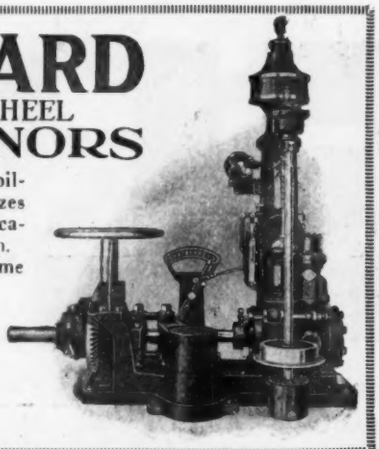
AIR PREHEATERS

From 217 to 66,942 sq. ft. of heating surface.

ENGINEERING

LOMBARD
WATER WHEEL GOVERNORS

Powerful, quick-acting oil-pressure governors in sizes and types for any application or special condition. For many years, the name LOMBARD has stood for *reliable service* and *closest regulation obtainable.*



THE LOMBARD GOVERNOR CO.
ASHLAND, MASS.

CONSULTATION with Woodward engineers and the installation of Woodward Governors will result in the turbines being controlled with entire satisfaction.
"Write for catalogue M"

WOODWARD GOVERNOR CO., Rockford, Ill.

WOODWARD
WATER WHEEL GOVERNORS

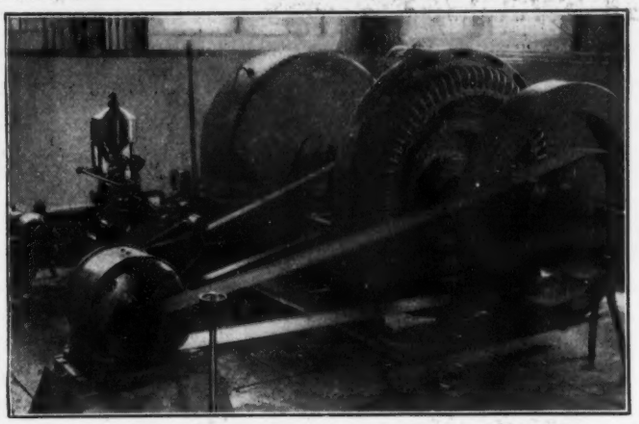
PELTON

High Efficiency in Small Units

The single overhung impulse wheel shown in the illustration represents the most modern advance in the design of small capacity units for specific operating conditions every detail being completed with the same precision that characterizes the engineering development and manufacture of large capacity turbines. This plant being semi-automatic, is arranged for remote setting of the power needle, and includes all the essential devices necessary to efficient and safe operation.

THE PELTON WATER WHEEL COMPANY
Hydraulic Engineers
2985 Nineteenth St., San Francisco 100 Broadway, New York

PELTON



THE BABCOCK & WILCOX COMPANY
85 Liberty Street, New York

Builders since 1868 of Water Tube Boilers of continuing reliability

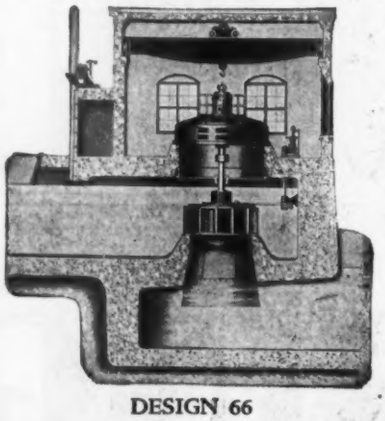
BRANCH OFFICES
Atlanta, Candler Building
Boston, 80 Federal Street
Chicago, Marquette Building
Cincinnati, Traction Building
Cleveland, Guardian Building
Dallas, Texas, Magnolia Building
Denver, 444 Seventeenth Street
Detroit, Ford Building
Houston, Texas, Electric Building
Los Angeles, Central Building

THE BABCOCK & WILCOX COMPANY — STEAM

WORKS
Bayonne, N. J.
Barberton, Ohio

Makers of Steam Superheaters since 1898 and of Chain Grate Stokers since 1893

BRANCH OFFICES
New Orleans, 344 Camp Street
Philadelphia, Packard Building
Phoenix, Ariz., Heard Building
Pittsburgh, Farmers Deposit Bank Building
Portland, Ore., Failing Building
Salt Lake City, Kearns Building
San Francisco, Sheldon Building
Seattle, L. C. Smith Building
Honolulu, T. H., Castle & Cooke Building
Havana, Cuba, Calle de Aguiar 104
San Juan, Porto Rico, Recinto Sur 51



DESIGN 66

TURBINE WATERWHEELS **LEFFEL** TURBINE WATERWHEELS

Design 66 illustrates an up-to-date hydro electric plant equipped with Leffel automatically controlled high speed vertical turbines driving generators direct, installed on a low head water power that had been abandoned many years—That old water power is now a valuable asset. We also furnish Leffel high efficiency—low, medium and high speed—turbines developing thousands of horse power for large capacity hydro electric plants.

Let our engineers show you what can be done.

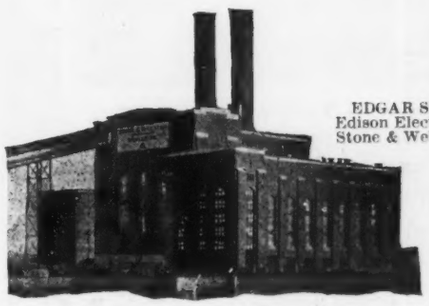
THE JAMES LEFFEL & CO., SPRINGFIELD, OHIO

BRANCH OFFICES

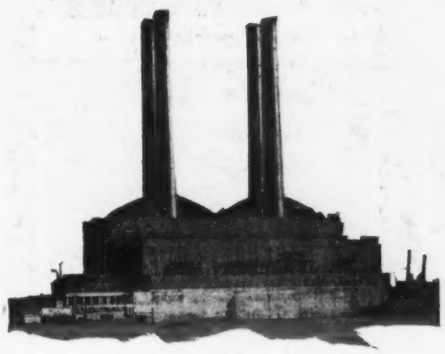
New York, N. Y....39 Cortlandt St.	Minneapolis, Minn.....Plymouth Bldg.
Boston, Mass. .....80 Boylston St.	Lancaster, Pa. .....Woolworth Bldg.
Atlanta, Ga. ...4th Nat'l Bank Bldg.	Wm. Hamilton, Ltd., Peterborough, Ont., Can.

CONNERY CONSTRUCTION

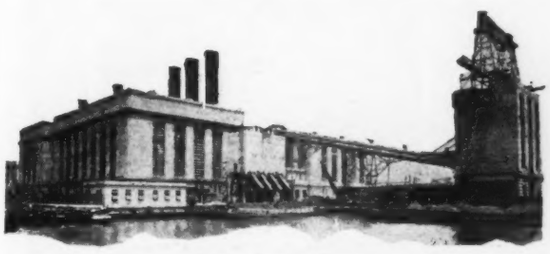
has made a reputation in the foremost Central Stations



EDGAR STATION
Edison Electric Ill. Co.
Stone & Webster, Inc.



CAHOKIA STATION
United Electric Light & Power Co.
McClellan & Junkersfeld



DELAWARE STATION
Philadelphia Electric Co.
(Also Chester Station)

Edgar Station, Cahokia Station, Delaware Station, Seal Beach, Buffalo, Sanford and many other central stations have adopted Connery's Improved Expansion Stiffener Construction, for boiler breechings, preheater ducts, air ducts and uptakes because it has proved its merit in actual operation.

Here are the four newest Connery Constructions to modern power plant design:

Connery's Improved Expansion Stiffener

"V" shaped projections pressed into the sheets while cold, utilizing the bellows principle to provide for contraction and expansion. Electrically welded, air and moisture tight construction eliminates buckling, warping and internal corrosion.

Connery's Improved Stack Connection

A rigid electrically welded steel form using the "V" shaped expansion stiffener, provides for connection of stack to breeching and for vertical and horizontal expansion. No other prepared forms are needed while building concrete or brick stacks. When grouted in the stack it forms a seal eliminating leakage at the stack opening.

Connery's Air Cooled Damper

Insures a continuous flow of cool air thus reducing the possibility of warping.

Connery's Adjustable Covering Attachment

For securing the asbestos at any distance from the breeching.

A Connery bid on your next job will prove to you that Connery Construction costs no more than regular construction. Our engineers will be glad to talk it over with you.

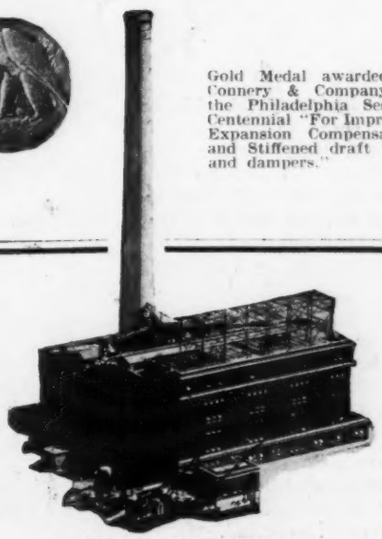
Home Office and Factory:

CONNERY & COMPANY, Inc.

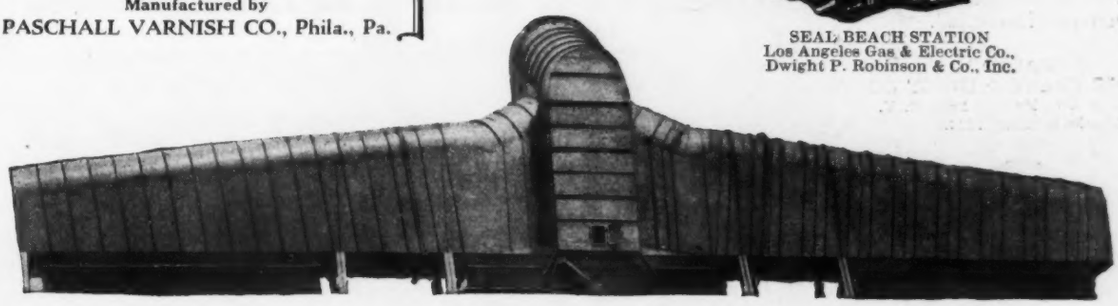
Second and Luzerne Streets, Philadelphia, Pa.

Branch Office: New York

Gold Medal awarded to Connery & Company at the Philadelphia Sesqui-Centennial "For Improved Expansion Compensating and Stiffened draft flues and dampers."



SEAL BEACH STATION
Los Angeles Gas & Electric Co.,
Dwight P. Robinson & Co., Inc.



WE RECOMMEND

TRUFILM

Heat Resisting Paint

Manufactured by

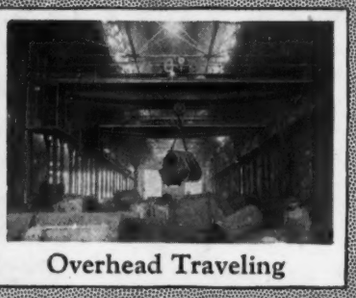
PASCHALL VARNISH CO., Phila., Pa.

Check Your Crane Requirements

OVERHEAD
TRAVELING
CRANES
- Box Girder
- Double Rolled Beam
- Compact
- Grab-Bucket
- Transfer
- Ice Plant
- I-Beam

JIB CRANES
BRACKET CRANES

Compact Crane


Overhead Traveling

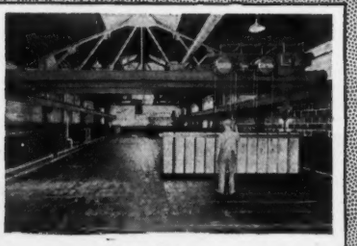
Transfer

Transfer

Grab Bucket

I-Beam

Transfer Cupola Charging


Ice Plant

I-Beam

Jib

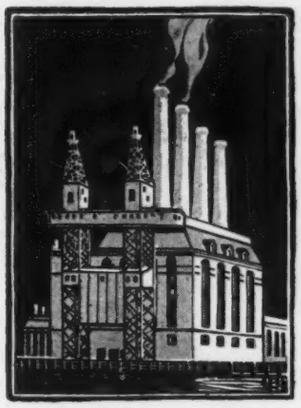
FOR ANY SERVICE you name, there is a Shepard Crane. Each type is performance-proved in the service for which it is recommended and is backed by a quarter century's experience in the design and application of lifting and load moving equipment.

With their Balanced Drive, enclosed unit construction and automatic oil bath lubrication they provide that which the user most desires—enduring care-free crane service.

Bulletins are available describing all of the equipment listed above. Write for copies of those in which you are interested.

SHEPARD
ELECTRIC CRANE & HOIST CO.
374 Schuyler Ave., Montour Falls, N. Y.
Branches in Principal Cities

SHEPARD
ELECTRIC CRANES & HOISTS



This advertisement is the second of a series outlining specific features of C. H. Wheeler Condenser design and construction.

FACTORS OF CONDENSER EFFICIENCY

II. *Pressure Drop*

The pressure drop from the exhaust steam inlet to the air pump suction should be a minimum in a properly designed surface condenser.

In C. H. Wheeler Condensers, differential or gradually diminishing tube spacing from the steam inlet insures proper steam distribution with the least resistance to the flow.

Through this arrangement a negligible pressure drop is obtained, between exhaust steam inlet and *air pump offtakes.* Thousands of installations of all sizes and types testify to the standards of maximum vacuum, conservation of pumping power, high condensate temperature and reliability common to all C. H. Wheeler Condensers.

We manufacture:

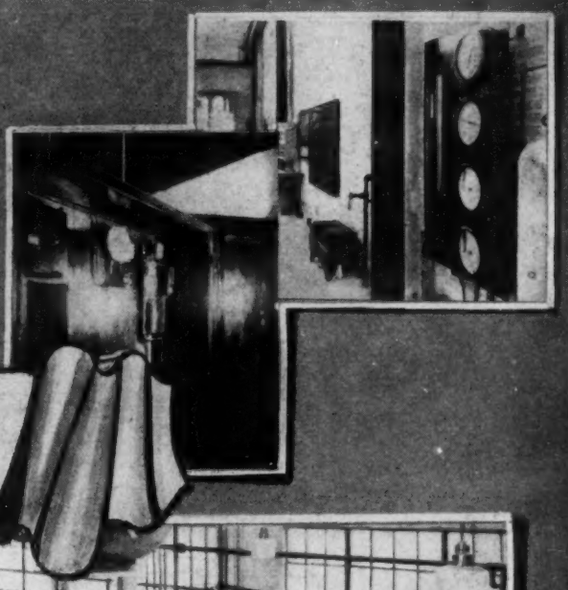
Surface, Jet and Barometric Condensers; Leach Fracto Condensers; Oil Vapor Condensers for High Vacuum Distillation; Heat Exchangers; Radojet Air Pumps for vacua up to 29.95 inches; Forced and Natural Draft Cooling Towers.

C. H. WHEELER MFG. COMPANY
19th Street, Lehigh & Sedgley Avenues
PHILADELPHIA, PA.

C.H.WHEELER *of* PHILADELPHIA

BRIS
Recording
an aid to
By reference to the daily records available through the use of Bristol's Recording Instruments, engineers are able to keep a close check on operating conditions and hence on efficiency all through the station.
The engineers for the Hudson Ave. Station, Brooklyn Edison Co.; Hell Gate Station of the United Electric Light & Power Co.; the Devon Station of the Connecticut Light and Power Co. and many other utilities have installed Bristol's Recording Instruments. These and many other stations designed to operate at a very high economy have taken every precaution in selecting accurate instruments. As can be seen Bristol's are used almost everywhere.

TOLS Instruments



better operation

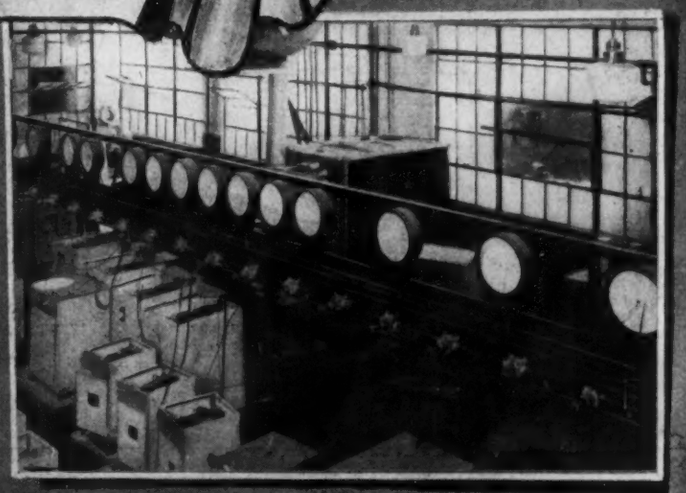
And there is a Bristol's Recording Instrument for every need. Not only a complete line of Electrical Recording, but also all kinds for use in the power plant, including:—

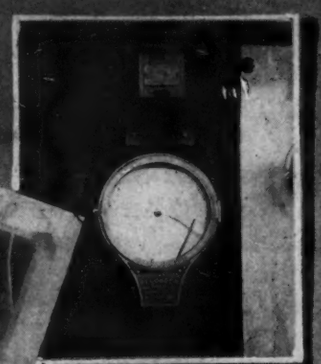
Voltmeters	Pyrometers
Ammeters	Psychrometers
Wattmeters	Electrical Operation
Millivoltmeters	Mechanical Motion
Shunt Ammeters	Tachometers
Frequency Meters	Revolution Counters
Pressure Gauges	Temperature Control Equipment
Vacuum Gauges	Long Distance Transmitting System
Liquid Level Gauges	
Thermometers	

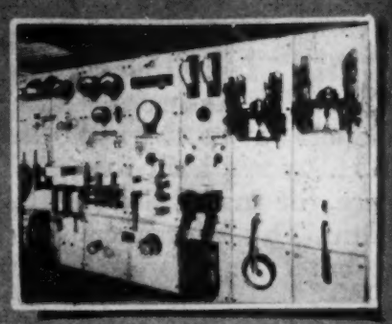
Our nearest sales engineer can advise in regard to proper application of Bristol's Recording Instruments in your plant.

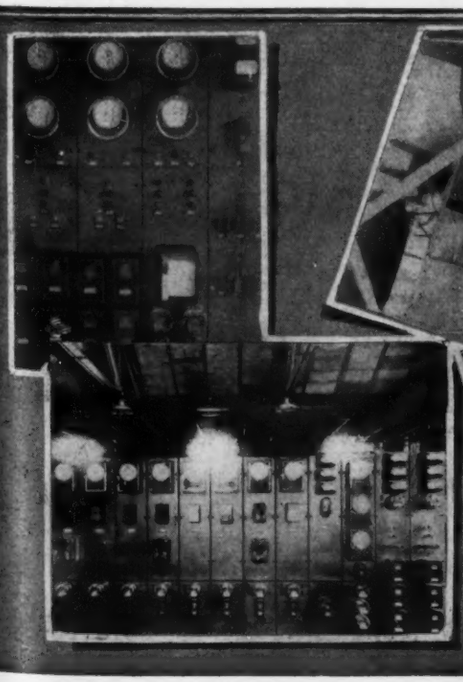
Valuable data on measuring and recording is given in Bristol's Electrical Catalogs, including—Voltmeters, Ammeters, Wattmeters—illustrated in a wide variety of models for permanent mounting and portable use. Send for these catalogs.

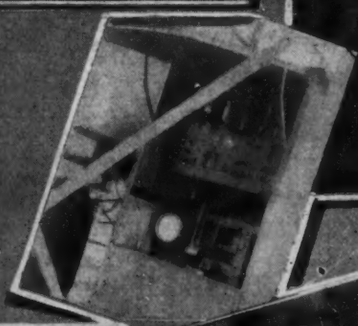
THE BRISTOL CO., Waterbury, Conn.

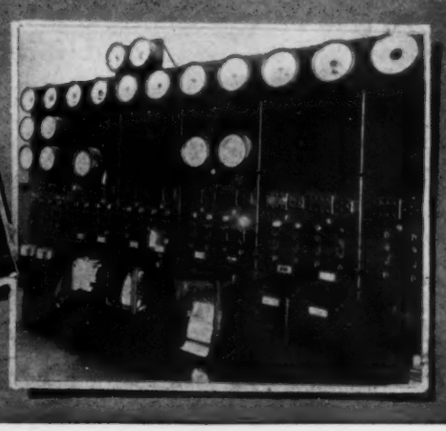




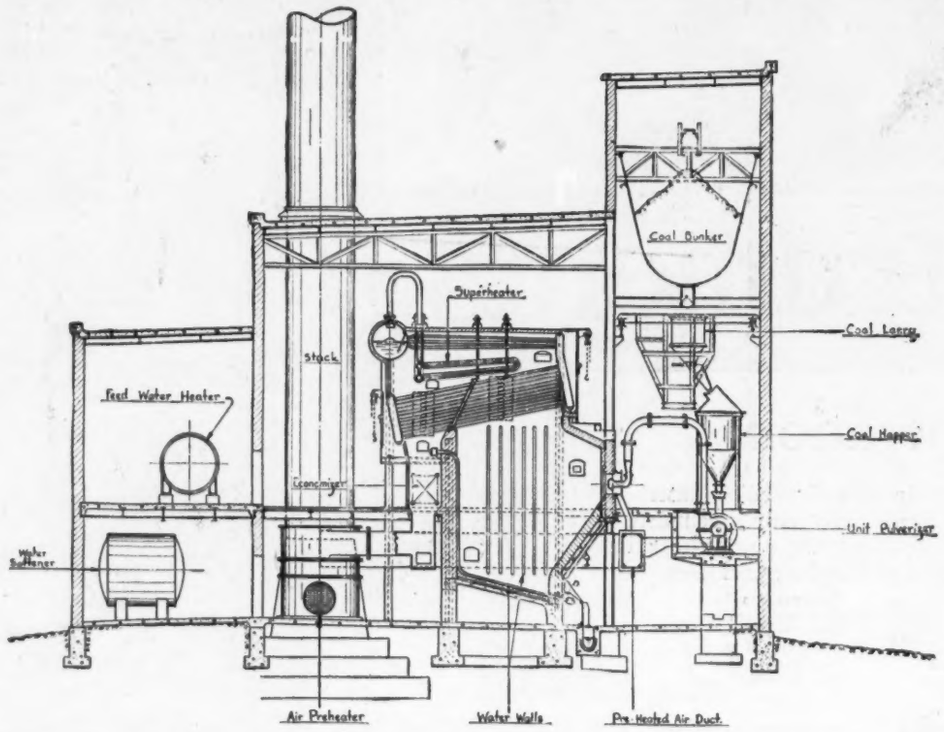








More EDGE MOOR CROSS DRUM BOILERS for West Virginia Pulp & Paper Company



Two 825 B.H.P. units for 425 lbs. pressure—18TH Order

THE West Virginia Pulp & Paper Company's eighteenth order for Edge Moor Boilers covers two cross drum units of 825 B.H.P. each, built for 425 lbs. working pressure, for installation in the Covington, Va., plant. This is practically a duplicate of their seventeenth order, dated August, 1926.

The new boilers for Covington will be equipped with water walls of the bare tube type, also designed and built by Edge Moor. These will be connected directly into the boiler circulation.

The boilers are of two-pass type, with superheaters, economizers and air preheaters, and equipped for pulverized coal firing.

The West Virginia Pulp & Paper Company's experience with Edge Moor Boilers dates back to 1899, since which time they have bought fifty-six units totaling 34,041 B.H.P. for service in their plants at Covington, Va.; Piedmont, W. Va.; Mechanicsville, N.Y., and Tyrone, Pa.

Convincing proof of Edge Moor service is contained in this thirty-year record of "repeat orders." The same service is available to every steam plant.

EDGE MOOR IRON COMPANY

Established 1868

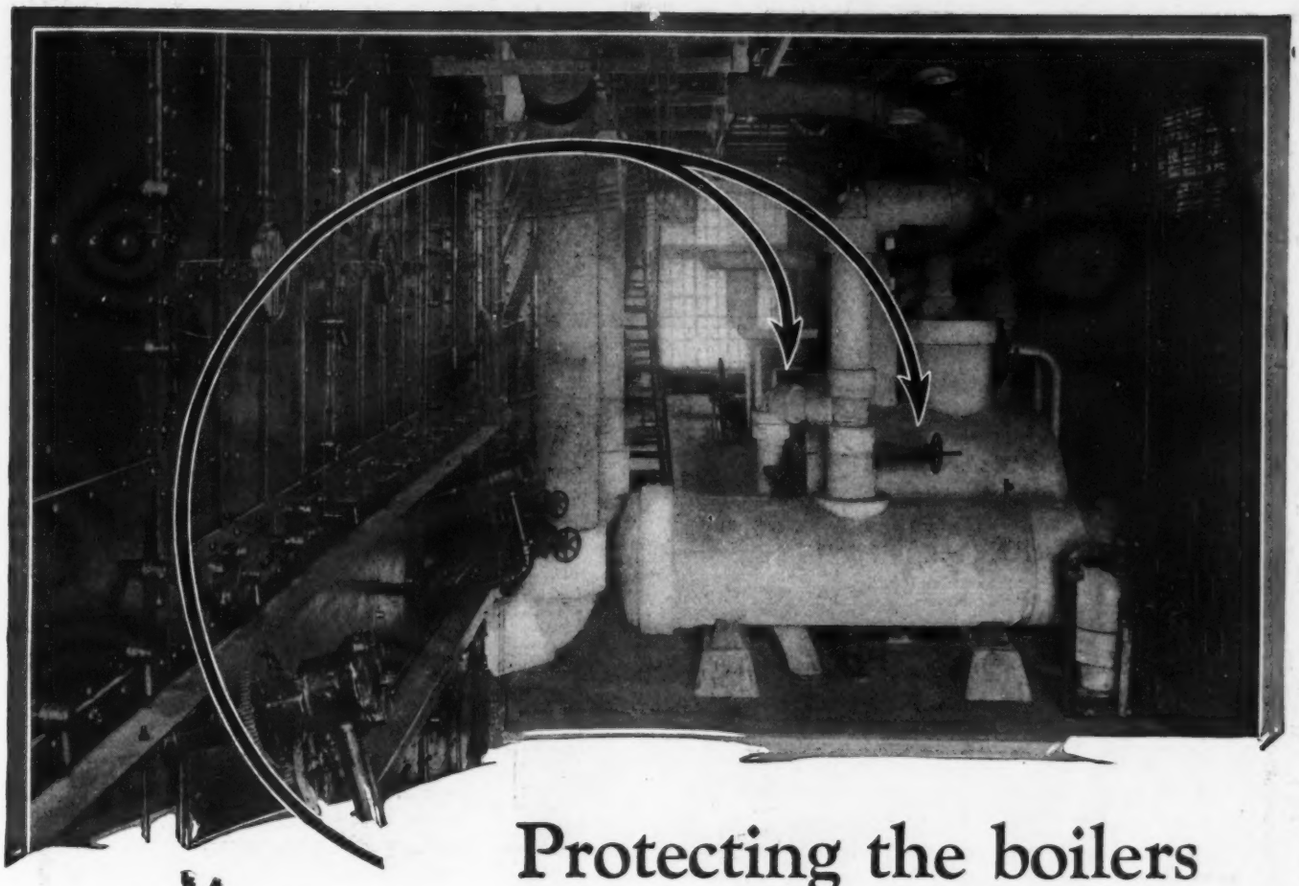
EDGE MOOR, DELAWARE

New York *Chicago* *St. Paul* *Los Angeles* *Charlotte*

EDGE MOOR BOILERS EDGE MOOR, DEL. U.S.A.

EDGE MOOR Water Tube BOILERS

STRAIGHT AND BENT TUBE TYPES—WATER WALLS—AIR PREHEATERS



Protecting the boilers from scale

THE place to deal with scale-forming solids in the boiler feed make-up is *outside* the boilers—not inside.

A G-R Evaporator completely removes all impurities from any hard, salty or dirty raw water *before* it reaches the boiler, and feeds into the boiler only absolutely pure distilled water.

G-R Evaporator-equipped plants are permanently free from scale troubles. The saving in wasteful blowdowns and costly tube cleaning usually pays for the evaporator in 18 months or less, and the boilers are enabled to operate at far higher ratings without danger of priming.

Write for full information.

G-R Evaporator Systems supply over 9,000,000 B. Hp.

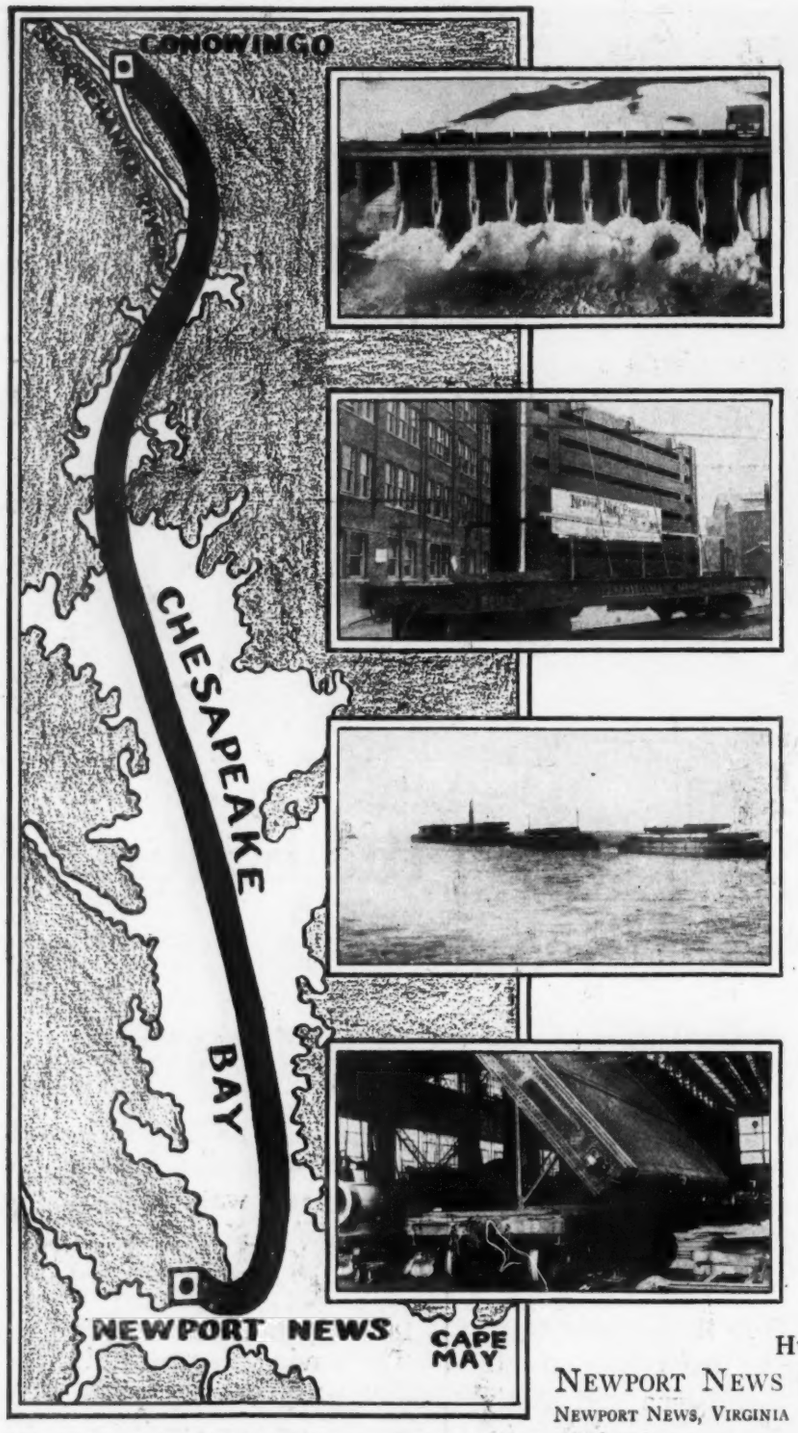
The Griscom-Russell Co.
285 Madison Ave.
New York

Philadelphia	St. Louis
Boston	Kansas City
Rochester	New Orleans
Pittsburgh	Houston
Columbus	Dallas
Massillon	Charlotte
Indianapolis	Atlanta
Chicago	San Francisco
Cleveland	Los Angeles
Detroit	Seattle
Milwaukee	Denver
Minneapolis	Tulsa

For Canada: Riley Engineering and Supply Co., Ltd., Toronto

Griscom-Russell

Heat Transfer Apparatus



5463 TONS of Newport News Hydro-electric Equipment at Conowingo

THE shipment of this tonnage of completely assembled equipment to Conowingo in itself constituted an engineering problem solved only by the unequalled situation and facilities of the Newport News plant. The 50 crest gates, each 40 ft. wide by 22 ft. 6 in. high, weighing 42 tons each, the three regulating gates (24 tons each) and the service gate (54 tons) were shipped by barge.

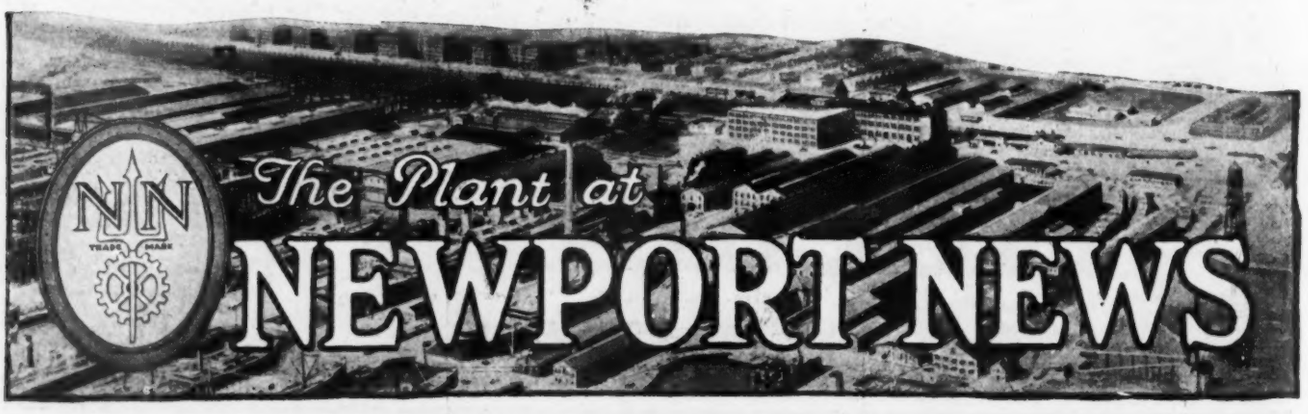
Newport News equipment plays a large part in the operation of the new Conowingo power project. Flood control is obtained with the 50 crest gates and the 3 regulating gates.

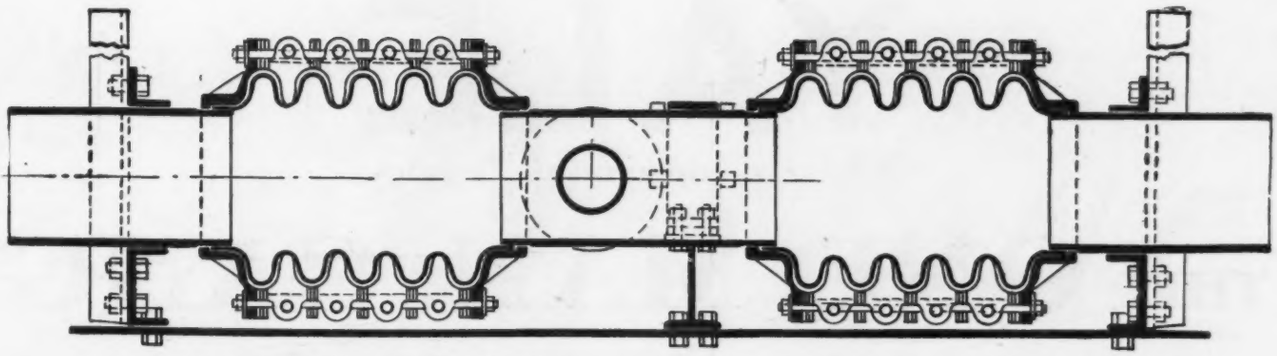
Trash is kept from entering the turbines by means of the Newport News electrically welded racks, which in turn are kept clean by a Newport News Mechanical Rack Rake.

The size and efficiency of Newport News equipment at Conowingo is testimony of ability to render service in hydro-electric developments.

Other Newport News equipment at Conowingo consists of 4 Sectional Head Gates, 2 Station Service Head Gates, 40 Stop Logs, 8 Stop Log Seals, 1 Station Service Stop Log, 8 Draft Tube Stop Logs, 70 Racks, 28 Rack Frames, 2 Station Service Racks, 4 Station Service Rack Frames and Guides for all Gates, Stop Logs and Racks.

HYDRO-ELECTRIC DIVISION
NEWPORT NEWS SHIPBUILDING AND DRY DOCK CO.
NEWPORT NEWS, VIRGINIA CHARLOTTE, N. C. NEW YORK: 233 BROADWAY





Badger Double Welding Self-Equalizing Expansion Joints With Structural Steel Anchor and Guides

Badger Flanged Type Double Expansion Joint with Structural Steel Anchor and Guides.

The new Badger bulletin also describes all types of single and multi-corrugated Badger Expansion Joints for use on overhead, low pressure and vacuum heating lines.

Send for your copy now.

Reduce installation cost and protect underground piping

Badger Welding or Flanged Type Double Expansion Joints with anchorage and service outlets are now furnished in complete units with structural steel guides, that maintain the pipe in accurate alignment. These units simplify installation and insure long trouble-free service without attention.

The expansion elements consist of one piece deoxidized copper sleeves, that are corrugated by a special rolling process which produces uniformity in contour and thickness of metal. They can neither stick nor leak. External machined equalizing rings, distribute all movements evenly among all the corrugations.

Guaranteed to 200 lb. working pressure.

Badger Engineering Service

Badger engineers are designers, manufacturers and installation experts for the following and kindred power plant products: Pipe Bends, Chemical Apparatus, Copper and Sheet Metal Work, Copper Boilers.

E. B. BADGER & SONS CO.

75 Pitts Street, Boston, Mass.

New York: 271 Madison Ave. **Chicago: 2831 South Parkway**

Representatives in all principal cities

BADGER EXPANSION JOINTS

ESTABLISHED 1841 · WEATHER VANE ON FANEUIL HALL · E. B. BADGER & SONS COMPANY · TRADE MARK

TRADE **YALE** MARK

Electric Industrial Trucks

THE ONE MAN GANG

the "One Man Gang," the Yale Electric Industrial Truck or Tractor cancels transportation costs in your plant

Yale Handles Loads Better—Yale Equipment Is Best

The Yale & Towne Mfg. Co., Stamford, Conn., U. S. A.

Canadian Branch at St. Catharines, Ontario

YALE **Hoisting and Conveying Systems**

YALE MARKED IS YALE MADE

P-192

IRVING CONTINUOUS FLOOR ARMORING

GIVES to a floor of concrete, mastic, asphalt or composition, the quality which none of these materials themselves possess—the ability to resist shock and abrasion. In this improved flooring construction, embedded bars of tough steel take the impact of falling loads and the grinding wear of rolling loads. Breaks, cracks, irregularities are impossible — the initial evenness of the floor persists indefinitely.

Write for Bulletin K-4.

Irving Armoring

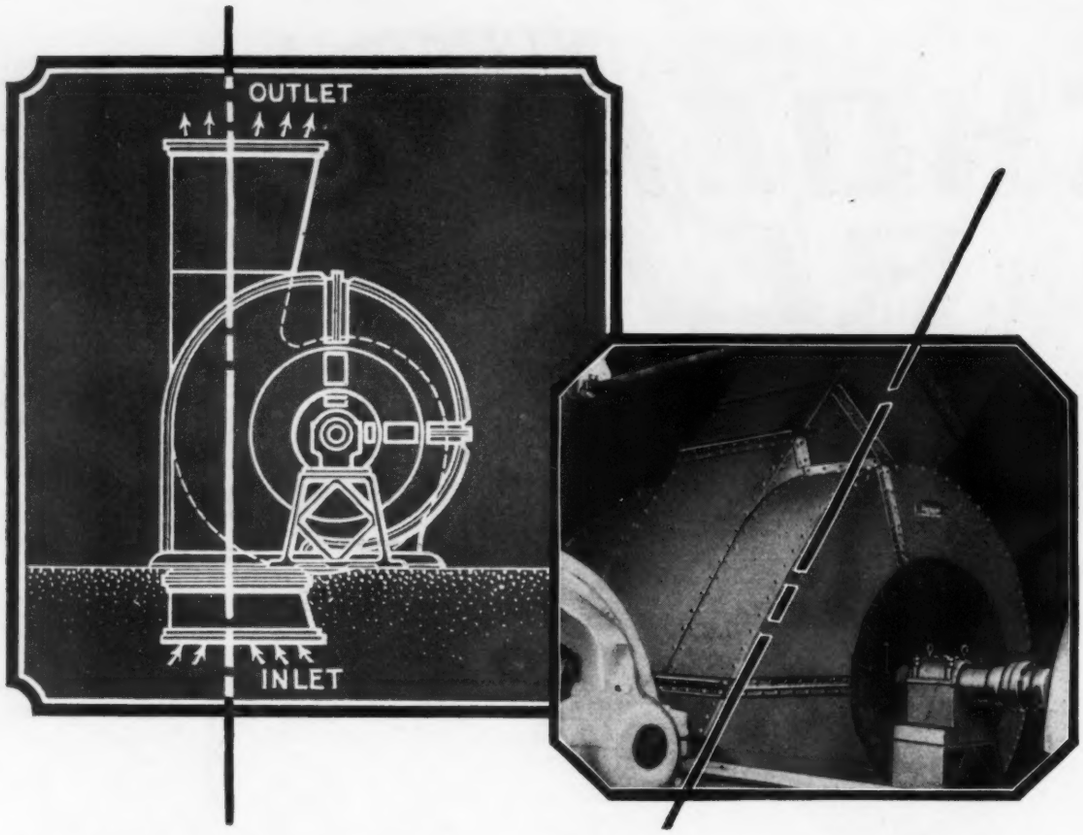
is a continuous trussed structure of steel—not a grouping of independent plates or panels. Weak butt joints—sure to yield under service—are replaced by the "Streamline" lapped joints, giving smooth continuity in every direction. The armoring cannot work loose—it is a permanent part of the floor.

IRVING IRON WORKS CO.

LONG ISLAND CITY, N.Y. U.S.A.

Established in 1902

ATLANTA, GA. BALTIMORE, MD. BIRMINGHAM, ALA. BOSTON, MASS. BUFFALO, N.Y. CHICAGO, ILL. CINCINNATI, OHIO
CLEVELAND, OHIO DALLAS, TEXAS DENVER, COLO. DETROIT, MICH. EL PASO, TEXAS HAVANA, CUBA HOUSTON, TEXAS
INDIANAPOLIS, IND. KANSAS CITY, MO. KNOXVILLE, TENN. MEXICO CITY, MEX. MILWAUKEE, WIS. MINNEAPOLIS, MINN. MONTREAL, P.Q.
PHILADELPHIA, PA. PITTSBURGH, PA. ST. LOUIS, MO. SAN FRANCISCO, CAL. SALT LAKE CITY, UTAH SEATTLE, WASH. SCRANTON, PA. UTICA, N.Y.



Built-in Centerlined Inlets and Outlets!

Save power—Simplify plant layout—
Improve plant appearance

AN INDUCED draft fan efficient in itself, does not always guarantee low cost operation. If poorly designed inlets and awkwardly shaped flue connections are used with such a fan, much power is consumed in overcoming the friction losses created. To prevent this wastage and provide for minimum friction in the flow of gases, Turbovane Type ID fans are built with centerlined inlets and outlets.

Because of this feature, the Type ID can be set in a straight flue section. The use of awkward right angle bends for inlet connections is made unnecessary. Turbovane ID inlets, scientifically designed, are *built-in*—made a part of the fan itself. Thus, a direct path for gases is afforded that reduces friction to a minimum—saves power and raises efficiency.

Centerlined inlets and outlets do more than assure induced draft economy. Plant layout is simplified by the use of straight flues and simplification always results in improved appearance of the plant.

Other features, including spiral inlets, direct motor drive, and new wheel design, also play an important part in making the Turbovane Type ID a highly efficient induced draft unit. Our nearest office will gladly supply full details.

B. F. STURTEVANT COMPANY, HYDE PARK, BOSTON, MASS.

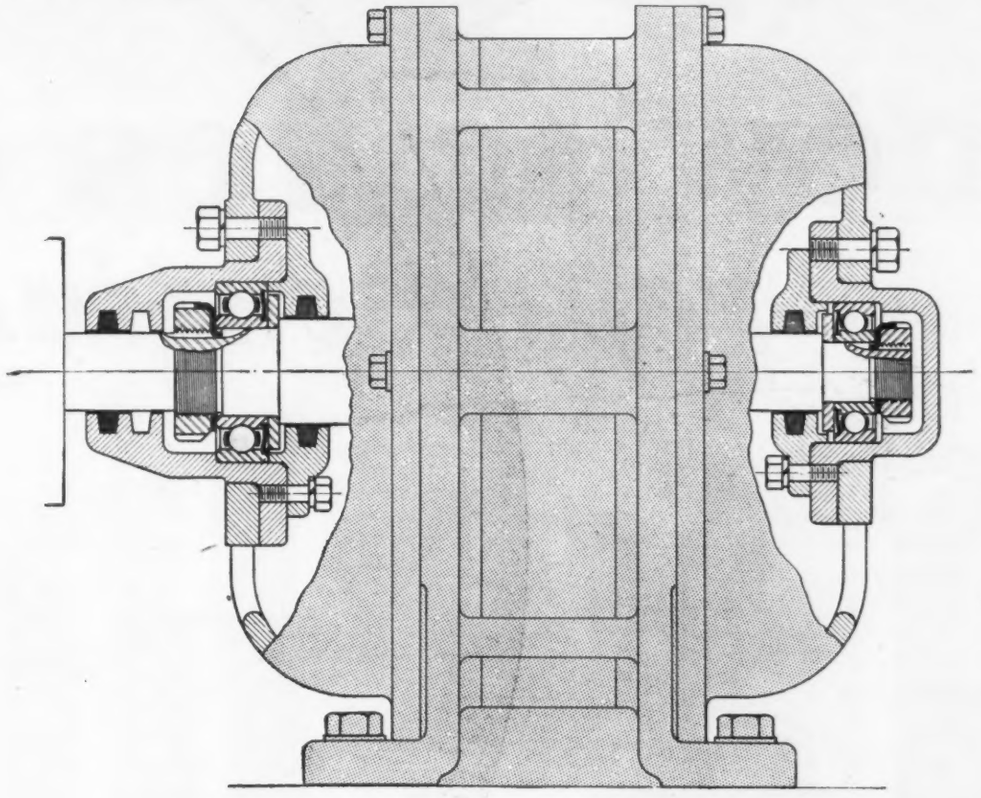
Atlanta	Charlotte	Dallas	Indianapolis	Minneapolis	Rochester
Birmingham	Chicago	Denver	Kansas City	New York	St. Louis
Boston	Cincinnati	Detroit	Los Angeles	Pittsburgh	San Francisco
Buffalo	Cleveland	Hartford	Milwaukee	Portland	Seattle
Camden					Washington, D. C.

Canadian Offices at: Toronto, Montreal, and Galt, Ont. Also Agents in principal Foreign Countries

Sturtevant REG. U.S. PAT. OFF. *Forced Draft Induced Draft* **FANS**

STEAM TURBINES ~ FORCED AND INDUCED DRAFT FANS ~ ELECTRIC MOTORS
FUEL ECONOMIZERS ~ GENERATING SETS ~ AIR PREHEATERS

ELECTRIC MOTOR "MAINTENANCE" PROBLEMS ARE SOLVED WHEN YOU USE THIS MOUNTING WITH SRB *LUBRI-SEAL* BALL BEARINGS

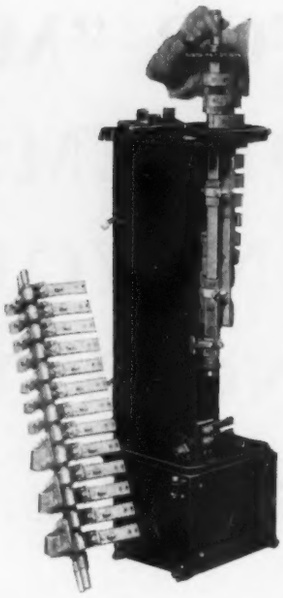


Dirt will not enter—lubricant will not leak out. Uniform air gap will be maintained because ball bearings properly protected will not show measurable wear after years of constant service.

STANDARD STEEL AND BEARINGS INCORPORATED

Plainville *Connecticut*

Ball SRB Bearings

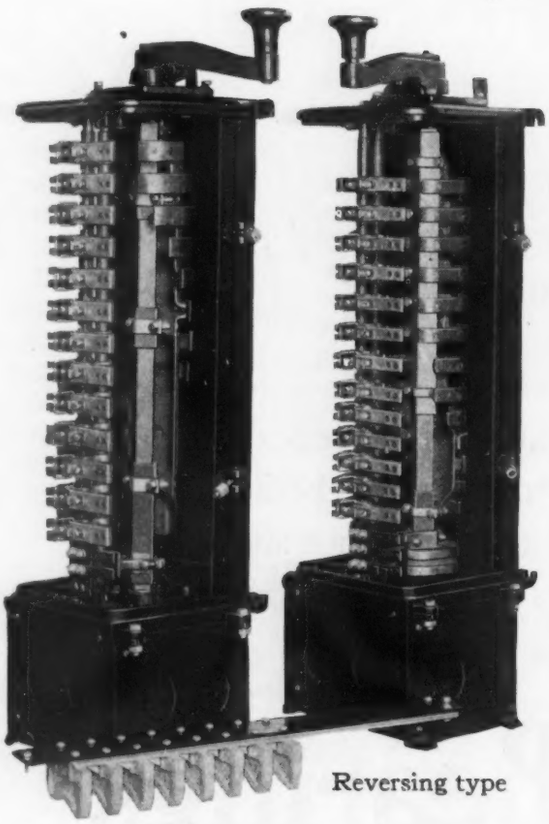


Showing complete cylinder, which is of solid cast brass with renewable copper segments, being lifted through top of head. The only tools needed for complete overhauling of a Union Drum are a pair of gas pliers and a screw driver. All parts cadmium plated except frame, which is finished in black Japan.

UNI

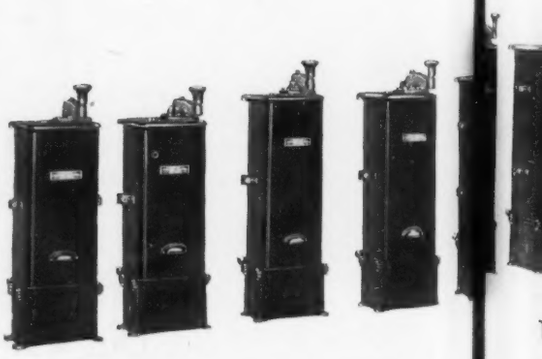
A new series of d

representing an



Reversing type

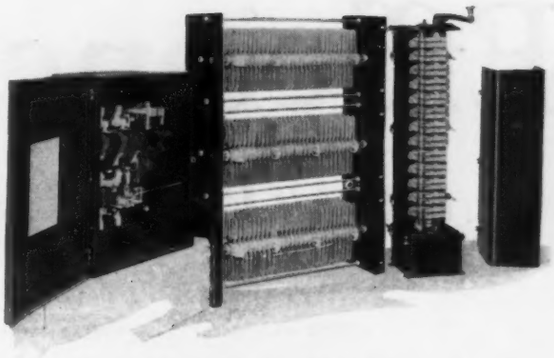
Non-reversing type



Here is a complete line of drum controllers, entirely new throughout, and far ahead of the usual type of drum switch in every detail. The result of many years of specialization, and embodying practical suggestions from many field men, we believe that these controllers are without an equal on the market today.

Union Electric M

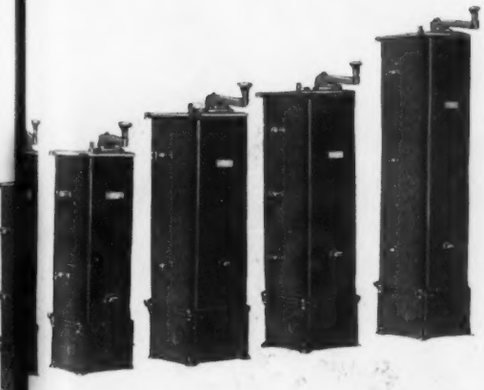
Milwaukee Wis



A typical installation. 150 hp. drum with speed regulating resistor and panel for primary protection of the motor. This apparatus is complete, including interlocks, low voltage, and overload protection. A 100% safe installation.

drum controllers

marked advance



Union Drums are mounted in unbreakable frames, with pressed steel back and sides welded to malleable iron head and bottom. This construction makes them very light in weight. The entire finger assembly can be readily removed, by taking off cap screws at top and bottom.

Made for reversing and non-reversing service.

Write for our Publication No. 500X.

Union Drums are built up of unbreakable material and are therefore shipped in light crates. Light original weight and light packing insure low freight charges.

Although Union Drums are built to the highest mechanical and electrical specifications without primary regard to cost, they are attractively priced. Every dollar invested in them will give a good account of itself.

Manufacturing Co.

Wisconsin

Efficiency
always out-earns its cost

C-H Valve Control saves labor—brings every valve under instant control, responsive to the touch of a finger. Because C-H Control operates any valve in a fraction of the time required by hand, even though rusty or "sticky," it saves time—protects men and equipment in emergencies.

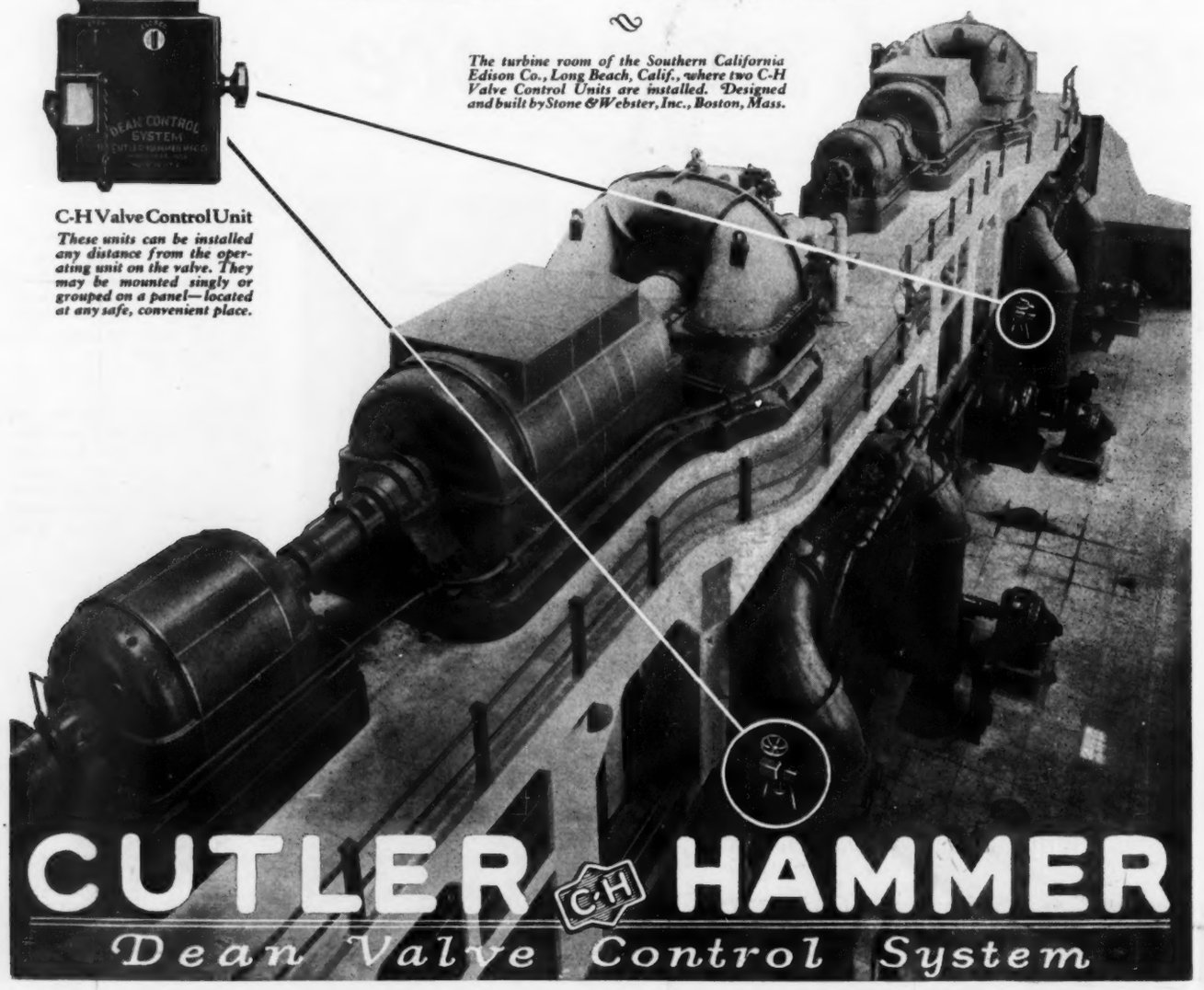
With C-H Valve Control proper sequences of valve operation can be established and followed automatically—an invaluable feature for fool-proofing equipment, for increasing the efficiency and safety of any plant.

Considering such advantages, why not start a thorough investigation now by simply writing for the booklet "Modern Valve Control Practice"?

The CUTLER-HAMMER Mfg. Co.
Pioneer Manufacturers of Electric Control Apparatus
1280 St. Paul Avenue - Milwaukee, Wisconsin

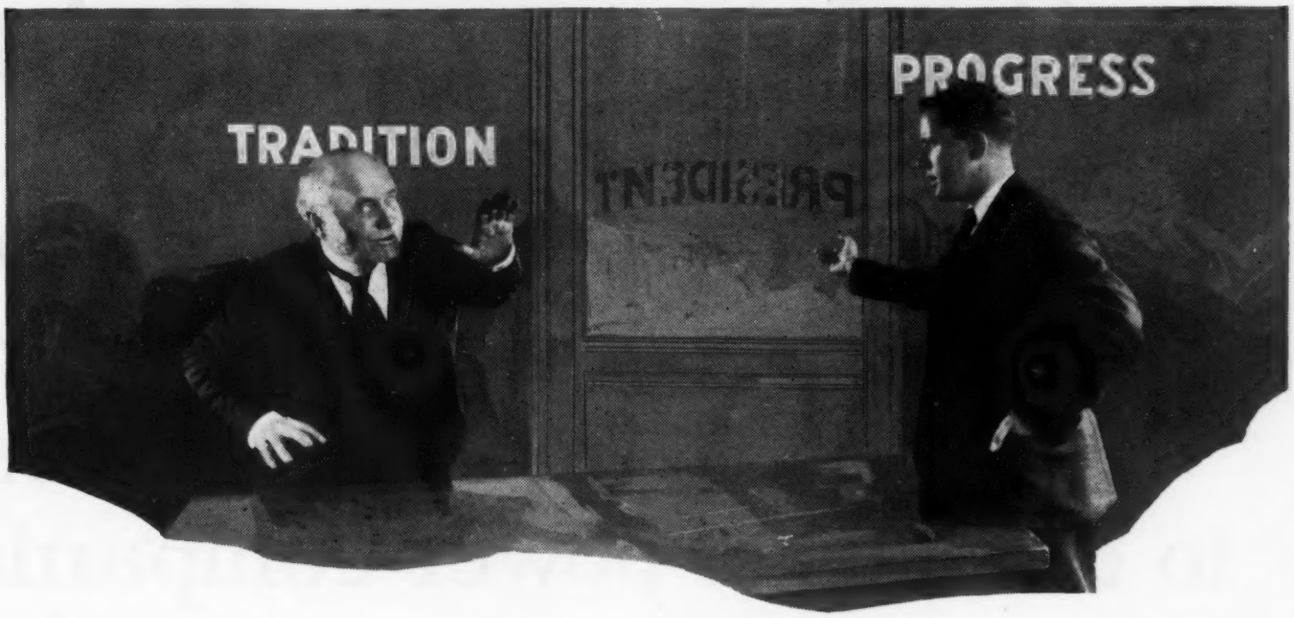
C-H Valve Control Unit
These units can be installed any distance from the operating unit on the valve. They may be mounted singly or grouped on a panel—located at any safe, convenient place.

The turbine room of the Southern California Edison Co., Long Beach, Calif., where two C-H Valve Control Units are installed. Designed and built by Stone & Webster, Inc., Boston, Mass.



CUTLER C-H HAMMER
Dean Valve Control System

Lad outlines Pop's executive duties.



"Here, Lad . . .

I don't want to seem arbitrary in holding off buying those 'Linc-Weld' motors, even though all the factories around here are doing it.

I just want to be sure I'm right. You know someone has said, 'I'd rather be right than be President'."

"Yes, Pop . . .

but it's perfectly possible to be both. In your job as president you are supposed to do everything possible to produce the savings that make a satisfactory net.

Now, every time a motor is taken out of service due to bearing trouble (and that's our biggest bill in motor maintenance) it isn't the cost of the bearing but the loss in production that runs so high.

On our 5 h.p. motors the bearings measure 4 sq. in.

Those on the 'Linc-Weld' are $7\frac{1}{4}$ sq. in.

The bigger bearings and shafts, better insulation and bigger ventilation area of the 'Linc-Weld' are features that you get only with that motor.

Those features produce REAL savings in production.

Remember that, because you know saving is like blonde hair— very little of it is real."

"Linc-Weld" Superiority is due to:

1. **Larger Shafts**
2. **Larger Bearings**
3. **Better Insulation**
4. **Stronger Frame (Steel)**
5. **Greater Overload Capacity**

The Lincoln Electric Co., Dept. No. 1-9, Cleveland, Ohio

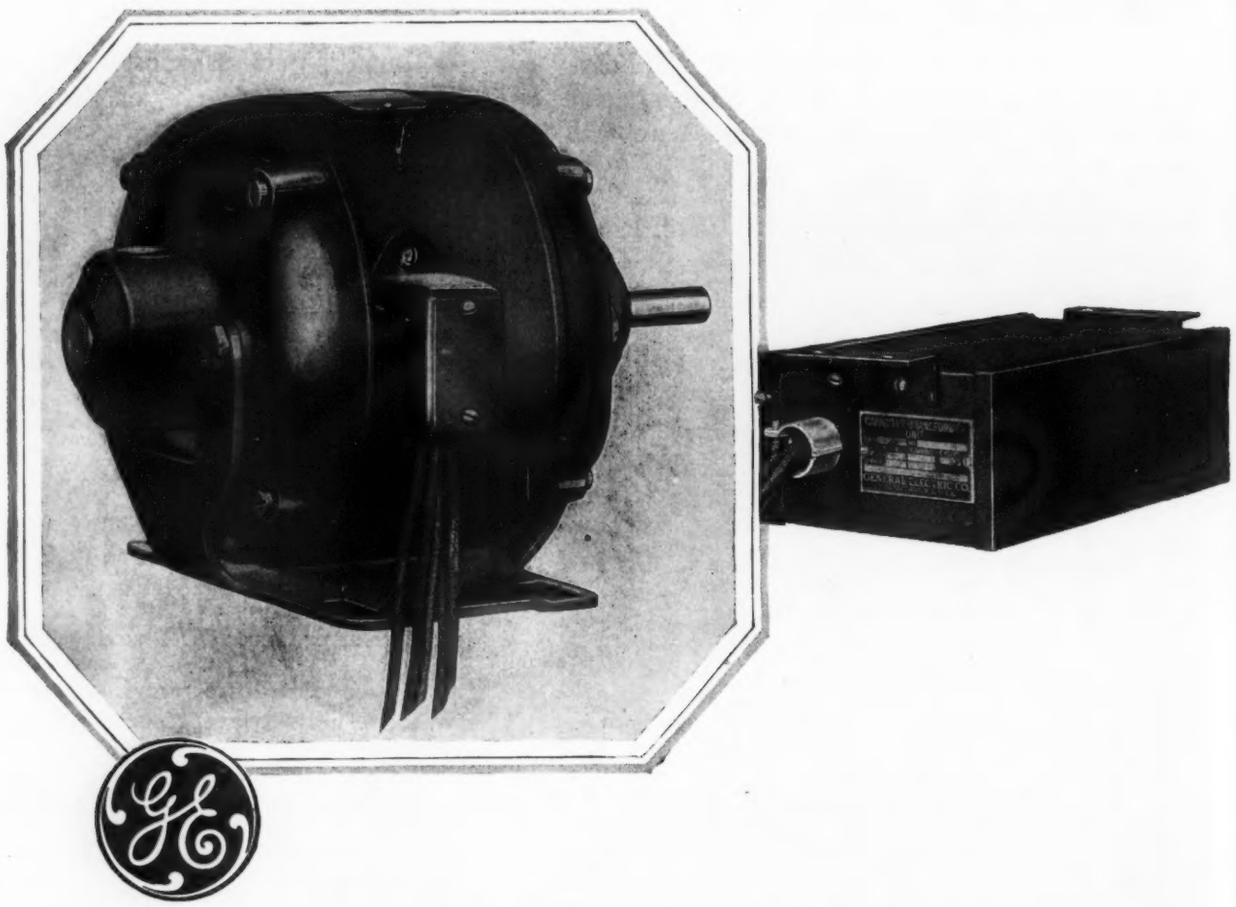
M-28

"Linc-Weld" LINCOLN MOTOR

The G-E Capacitor-Motor

TYPE RKS

A development of primary interest to officials of power companies



GENERAL

GENERAL ELECTRIC COMPANY, SCHENECTADY, N. Y.

Four outstanding features

of the G-E capacitor-motor

1 **High power-factor and low starting current minimize investment.**

2 **Simple construction, with no commutators or brushes, practically eliminates servicing.**

3 **High efficiency cuts operating costs.**

4 **Remarkable torque characteristics and quiet operation provide satisfactory performance.**

A contribution by General Electric to the advancement of power distribution

This single-phase motor was developed by General Electric primarily for use in its refrigerators. It consists of a simple squirrel-cage-type motor combined with a simple and compact capacitor. It is the ideal power unit for refrigerator, oil-burner, and similar household service.

Simple, quiet, reliable; with high power-factor and high efficiency; with remarkable torque characteristics; with no commutators or brushes—no wonder this power unit so appeals to distributors of electric power.

The thousands already in use testify to its performance. It is a motor you can install and forget. For complete details, apply to the nearest G-E office.

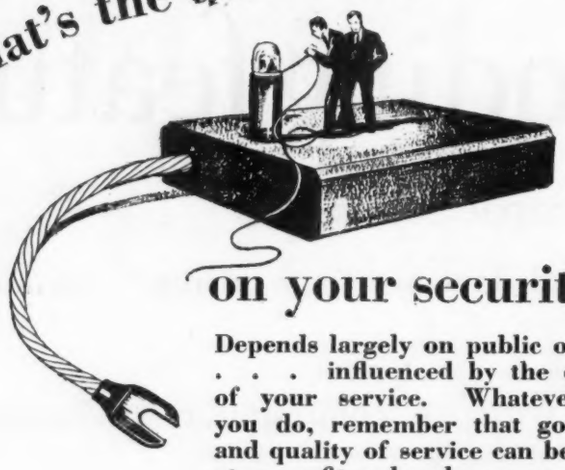
The serious problems in distribution, arising from the vastly increased use of electric power in households, are solved by the G-E capacitor-motor—a power unit with all the desirable characteristics demanded by engineers of power companies. Commercial men are equally interested in this development—a contribution by General Electric to the advancement of power distribution.

210-86

GENERAL ELECTRIC

SALES OFFICES IN PRINCIPAL CITIES

What's the quotation



on your securities?

Depends largely on public opinion . . . influenced by the quality of your service. Whatever else you do, remember that good-will and quality of service can be given at a profit only when your generators, motors and rotaries are equipped with the proper brushes. Realization of that fact and searching tests have led Speer Brushes into many of the most important utility plants.

SPEER CARBON COMPANY, Saint Marys, Pennsylvania

Speer Carbon Brushes

2790 R

ANTIQUES

WHEN a USG brush heaves its last sigh—it's an antique—not prematurely gray. USG brushes last so long they're nearly forgotten—because while they last they operate smoothly—silently—efficiently.

Try a set of USGs on any motor in your shop. When they're ready for the ashcan you'll be so much older you'll wonder when they put 'em on.

THE UNITED STATES GRAPHITE COMPANY

SAGINAW, MICHIGAN

DETROIT ELECTRIC FURNACES
will
Build Power Business
for
THE CENTRAL STATION
Let us help increase your revenue
Detroit Electric Furnace Co.
825 W. Elizabeth St., DETROIT

APEXIOR
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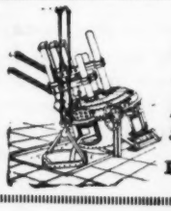
—an accepted protective coating for hot water and steam surfaces of boiler plant equipment.
Write for Bulletin
The DAMPNEY CO. OF AMERICA, Hyde Park, Mass.



Moore Rapid Electromelt Furnaces
Ten Standard Sizes ½ to 24 Tons Capacity
Most Rapid and efficient for making
Tool Steels, Alloy Steels, Forging Steels
Steel Castings, Malleable Iron, Grey Iron
Carbide, Ferro-Alloys etc.
PITTSBURGH ELECTRIC FURNACE CORPORATION
P.O. Box 1125. PITTSBURGH, PA.

ZOBELL ELECTRIC MOTORS

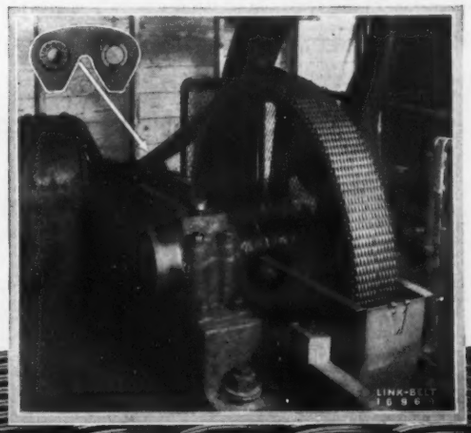
Superior 1 to 5 H.P. motors, D.C. or A.C., built on a sectionalized plan. Can be used for special applications without excessive developing cost. *Write for Bulletin.*
Zobell Electric Motor Corp., Garwood, N. J.

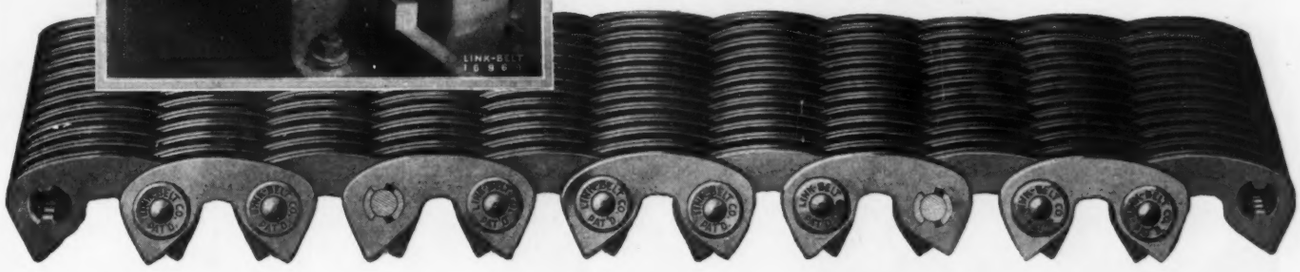
Chain Drives for Every Service

LINK-BELT builds every type of efficient and positive power transmission for any horsepower: for high or low speeds; or for minimum or maximum reductions.

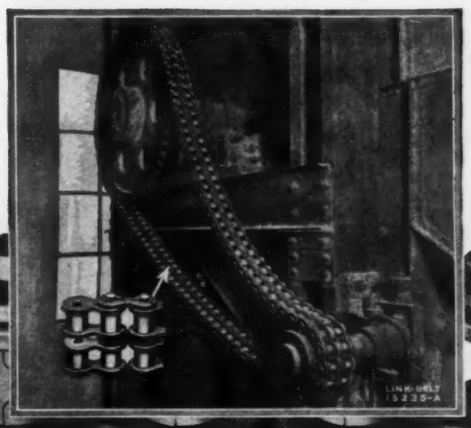
We are therefore in a position to offer unprejudiced recommendations as to the type of transmission most suitable for existing conditions.

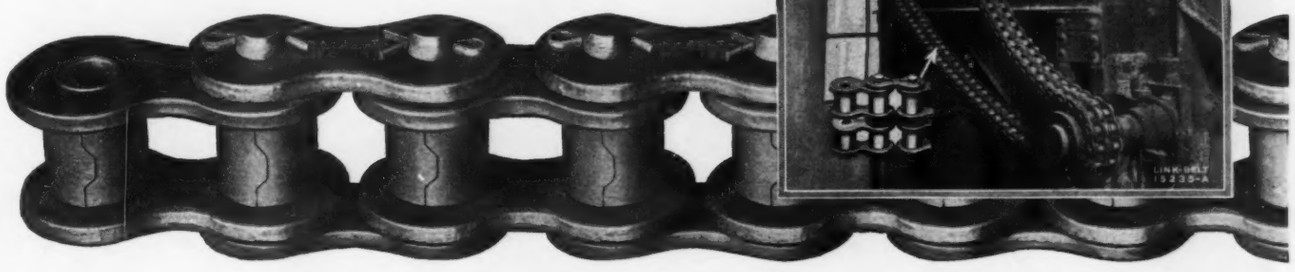
In every industry—on practically every type of machine, Link-Belt Silent Chain today is proving its claims to greatest reliability, efficiency and economy. Its action is positive under all conditions. By actual test it delivers 98.2% of the energy of the prime mover. Send for copy of Data Book No. 125.





Link-Belt "Proof-Tested" Steel Roller Chain has greater "chain mileage" built into it by the use of the famous Link-Belt Curled Roller, careful selection of materials, and heat treatments of all parts. Furnished in single and multiple strand widths. Data Book No. 257 sent upon request.





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LINK-BELT COMPANY

Leading Manufacturers of Elevating, Conveying, and Power Transmission Machinery and Chains

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SILENT AND ROLLER CHAIN DRIVES

Use *the* Right Motor

Whatever you need in motors . . . mechanical simplicity; automatic starting; high efficiency in starting and in running; adjustable speed; quietness; regulation of power-factor; protection from fumes or dust . . . Wagner makes every commercial type of alternating current motor.

Wagner engineers invite you to submit your motor problems. They can advise without prejudice.

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WAGNER ELECTRIC CORPORATION
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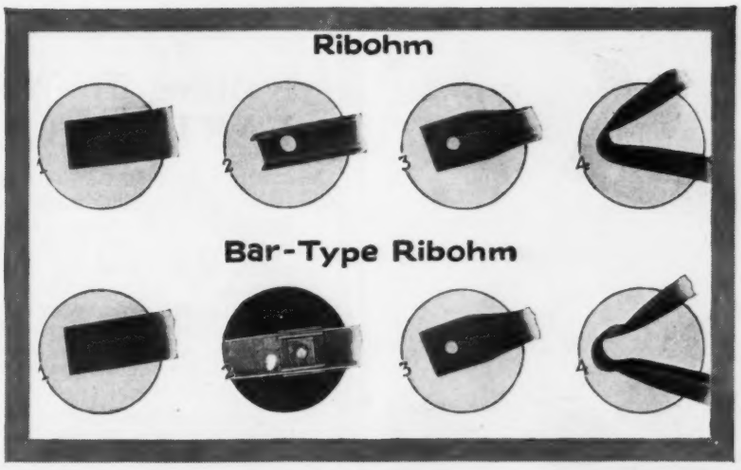
WAGNER SALES OFFICES & STATIONS IN 25 PRINCIPAL CITIES

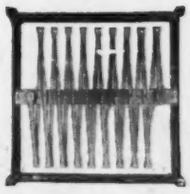
Products: FANS . . . . Desk, Wall and Ceiling
TRANSFORMERS . . . Power, Distribution and Instrument
MOTORS . . . Single-phase, Polyphase and Direct Current

Wagner ... quality

Ribohm

1. A metal ribbon of appropriate size and alloy
2. Is punched and formed into a "U" shaped channel and
3. After flattening at the ends and center
4. Is bent into a "V" shape, forming a complete resistive element, several of which make up the complete rheostat illustrated above.





Bar-Type Ribohm

1. A metal ribbon of appropriate size and alloy
2. Is punched and formed into a "U" shaped channel with provision for mounting and extra terminals and,
3. After flattening at the ends,
4. Is formed with specially shaped bends into a continuous resistive element, as illustrated above.

Standard and Bar-Type Ribohm Resistors

IF YOU manufacture electrical control equipment employing large current capacity resistors and rheostats, Ribohm should be considered.

Ribohm is a patented resistive element made only by the Ward Leonard Electric Co. It was developed to take the place of bulky or heavy, or fragile resistors, such as cast iron grids, in heavy duty circuits.

Seven years of actual service in the field have proved the superiority of Ribohm Resistors in a great many applications now using resistors of other types. The advantages and limitations of Ribohm are known to us. Your engineering department will find ours ready to cooperate in determining the best application of Ribohm to your apparatus.

* * *

Ribohm Resistors are made in two forms which are identical electrically: (1) Standard Ribohm consists of individual "V" shaped resistors which are mounted in groups upon a suitable panel or base. This

Electric Control Equipment
WARD LEONARD ELECTRIC CO.
Mount Vernon New York

assembly frequently eliminates all internal wiring back of the panel. (2) Bar-Type Ribohm is a continuous element from terminal to terminal, except where tapered resistance is required. The continuous element eliminates entirely, all contact resistance.

Both types of Ribohm are made of a special metal ribbon of appropriate size and alloy, formed into a "U" channel for structural strength, and then bent into the proper shape for mounting. The cross section of the formed element is uniform, thus eliminating "current crowding" and consequent non-uniform heating. The channel shape, and special form of the bends, gives an element which is light, rigid, strong, and entirely self-supporting, even under exacting operating conditions.

The method of mounting and shape of the bends permits expansion and contraction without stress to either the resistive element or mechanical support. The little mass and great structural strength of Ribohm makes it the ideal unit for use where excessive vibration exists.

Unlike cast grids and other types of resistors, Ribohm resists corrosive action by moisture and atmospheric gases.

Weight for weight, Ribohm will dissipate more energy continuously than any other resistor of the same rating, and will occupy less volume in meeting this condition.

The weight of a Ribohm element is approximately 10% of a cast grid of the same rating. The complete Ribohm assembly weighs from 25% to 33% of an equivalent cast grid assembly. It is lighter than ANY other resistor of the same rating.

You will find Ward Leonard ready to work with you on the application of Ribohm to your control. Ask for a representative to call, or we shall gladly send you Bulletins on the subject.

This Coupling Does What a Coupling Should Do

The best way of taking care of trouble is to prevent it. That's what a Falk Flexible Coupling does. Vibration and shock, repeated impacts, cause most of the trouble on direct connected drives. The Falk Coupling absorbs these causes of trouble as readily as it accommodates misalignment resulting from other causes. The design, which takes up shock, makes this coupling truly flexible. It gives free end float at all loads. No binding in its action to set up end thrust or cross pulls. No wearing parts to lock in an off position. An engineered product throughout. The Falk Coupling carries an unqualified guarantee. These couplings are economical in any service because they insure better operation, lower maintenance.

THE FALK CORPORATION
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Detroit Chicago Denver San Francisco Portland Minneapolis
Canada: The William Kennedy & Sons, Ltd., Owen Sound, Ontario
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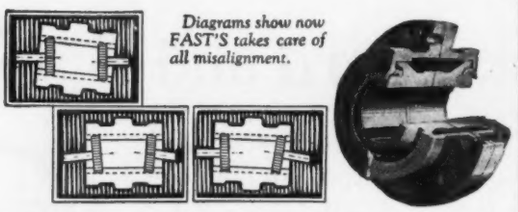
FALK OIL ENGINES | FALK HERRINGBONE GEARS | FALK SPEED REDUCERS | FALK FLEXIBLE COUPLINGS | FALK STEEL CASTINGS

Nothing To Wear Out In FAST'S COUPLING

THE GREATEST forward step in the history of flexible coupling design—elimination of flexible materials. In the six years since the introduction of Fast's couplings, they have demonstrated that eliminating flexible materials eliminates replacements forever.

Two spur gears, one on each shaft end, are completely and continuously meshed in oil with the internal gears of a floating sleeve. The shafts and sleeve turn noiselessly as one unit, allowing free angular and lateral movement.

Instead of misalignment being absorbed by flexible bushings, pins, springs, discs or grids, oil between the gear teeth, under high centrifugal pressure, carries the load. There is no power loss and the coupling will last at least as long as the connected machines.



Diagrams show how FAST'S takes care of all misalignment.

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Brass, Steel and Copper Washers
Flat, Bevelled or Countersunk
Special Sizes and Shapes
Prompt Deliveries Let us have your inquiry
Massachusetts Machine Shop, Inc.
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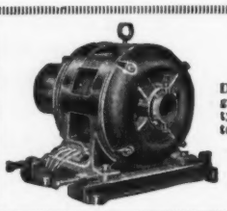

STAR
Ball Bearing Motors
Direct and Alternating Current up to 75 hp. Also generators and alternators in horizontal and vertical types, and motor generator sets. We build motors to meet your requirements. *Ask for more data.*
Star Electric Motor Co.
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it's Automatic When You Think of Motor Control
A COMPLETE LINE OF AUTOMATIC STARTERS FOR THE INDUSTRIAL PLANT
(Write for Catalog)
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Industrial Controller Co.
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THE MOST COMPLETE LINE OF BALL TYPES AND SIZES IN AMERICA BEARINGS
FAFNIR
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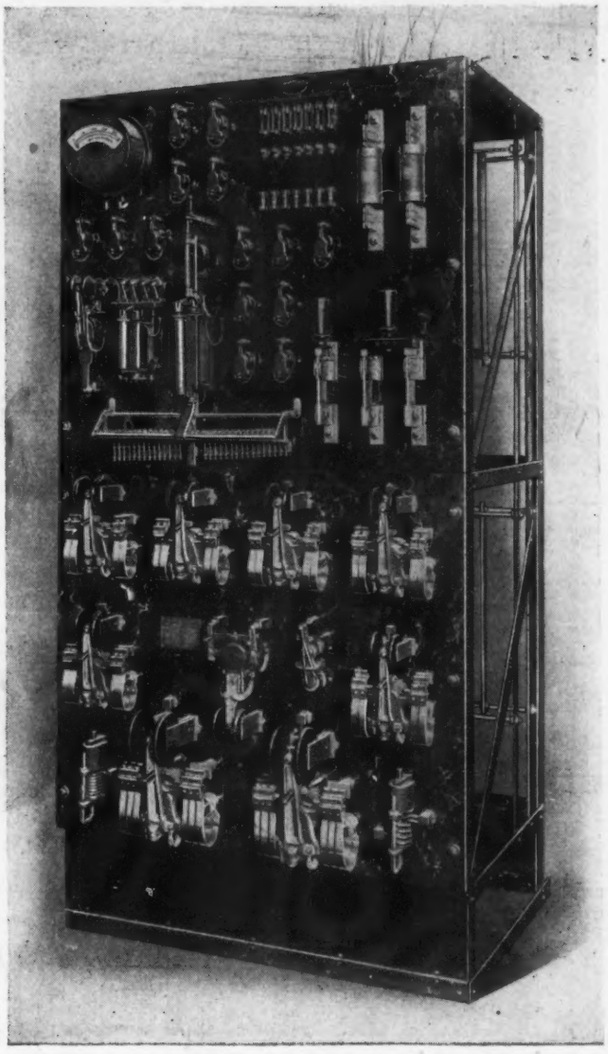
THE FAFNIR BEARING CO. NEW BRITAIN, CONN.

Wanted...

20:1 *speed range*

Monitor did it with a full automatic



Calenders, to do their best work, require perfect speed control over a wide range. They must start smoothly and pull steadily up to running speed.

It must be possible to inch the rolls and run them slowly, then accelerate smoothly. While running, the speed must be under perfect control to decrease or increase without jerks.

Monitor engineers have developed a full automatic system that protects the operator, the machine and the motor. It provides inching and smooth speed changes over any necessary range. In calenders a range of 20:1 between low and high speed is sometimes desirable and Monitor meets all requirements. All speed changes are made with two push buttons.

Start, stop and inching are done with a lever.

MONITOR CONTROLLER COMPANY
Gay, Lombard and Frederick Streets, Baltimore, Md.

IF YOU HAVE A SPEED CONTROL PROBLEM, PUT IT UP TO MONITOR

Monitor *does it automatically*

8534-17

SARA-DJINGE

When you speak of lipsticks to a sara-djinge woman you're talking of something real.

Starting in girlhood sticks are put in the child's mouth to stretch the lips.

This is kept up until the mature woman can easily wear a 10-in. wooden plate.

Curious how a person becomes hardened to what seems like torture.

We've seen an operator of rotaries heartily praise their quiet operation when the commutators fairly screeched under brush misapplication.

Sometimes a prescription of Morganite brushes for such a man is questionable because the resultant stillness might be his undoing, in the sense that an aviator is disturbed by the hush of an automobile engine.

Morganite Brush Co., Inc.

Main Office and Factory

3302-3320 Anable Ave., Long Island City, N. Y.

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Cleveland, Electrical Engineering & Mfg. Co., 320 Union Building.

Baltimore, O. T. Hall, Sales Engineer, 432 North Calvert St.

Revere, Mass., J. F. Drummey, 75 Pleasant Street.

Los Angeles, Electrical Engineering Sales Co., 502 Delta Bldg.

San Francisco, Electrical Engineering Sales Co., 222 Underwood Bldg.

Toronto, Can., Railway & Power Engineering Corp., Ltd., 133 Eastern Ave.

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CONTROLLED
Ventilation or Radiation

A turn of a switch will give ½, ¾ or full speed when a fan or blower is equipped with a Baldor Type C Condenser Motor and Controller. Send for complete details. Bulletin No. 11 contains complete information about this and other unusual developments in the electrical industry. Send for your copy today.

BALDOR ELECTRIC CO.
4354 Duncan Ave.
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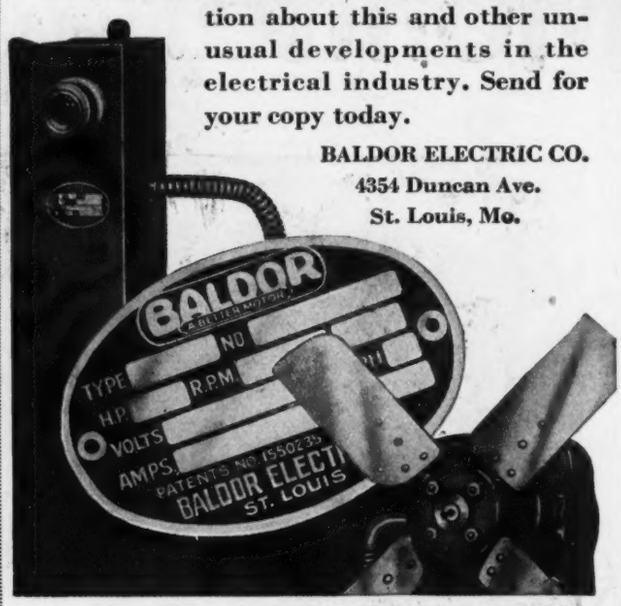
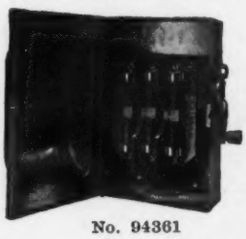


"R.M." TYPE
600 V. A. C.
Two-Position Motor Starting Switch



No. 94361

Shunts the fuses while Motor is gaining speed.

Made in 2- and 3-Pole sizes for 440 and 550 v., a.c. Motors rated up to 7-½ hp.-Polyphase.

Send for Bulletin 7 listing our complete line of Safety Switches and Panel Boards.

THE TRUMBULL ELECTRIC MFG. CO.
Plainville, Conn.

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BURKE ELECTRIC CO.
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MOTORS, ALTERNATORS, GENERATORS, MOTOR GENERATOR SETS, TRANSFORMERS, ARC WELDING EQUIPMENT

Sales Offices: Buffalo, Chicago, Cleveland, Detroit, Erie, New York, Philadelphia, Pittsburgh

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MARBLE-CARD MOTORS

D. C. and A. C., Ball Bearing Motors of the medium commercial sizes. D. C. machines up to 75 HP. with Commutating Poles. Get Bulletin No. 200.

A. C. Machines up to 75 HP. All standard speeds and voltages. Get Bulletin No. 300.

Special machines built to meet your needs Full details cheerfully supplied. Write

Marble-Card Electric Company
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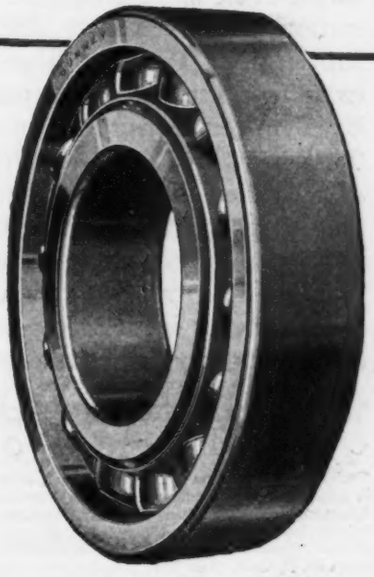
The outstanding characteristics of PENNSYLVANIA PUMPS are their high quality of design —their sturdiness and simplicity of construction

Ball Bearings Insure Continuous Operation



The Pennsylvania Pump and Compressor Company have found that Ball Bearing Centrifugal Pumps operate successfully even in inaccessible places where they receive but occasional service attention. Unaffected by variations in temperature, peak loads or maximum speeds, the Ball Bearing carries on its work with an enduring accuracy unequalled by any other type of bearing.

The all-around adaptability of the Ball Bearing to mounting conditions makes this feature of permanent, trouble-free performance available to manufacturers of machinery, tools and equipment in every line of industry.

Our Engineering Department will gladly help you apply these advantages to your product.

GURNEY BALL BEARING DIVISION
OF
Marlin-Rockwell Corporation
402 Chandler Street Jamestown, N.Y.

GURNEY
BALL BEARINGS

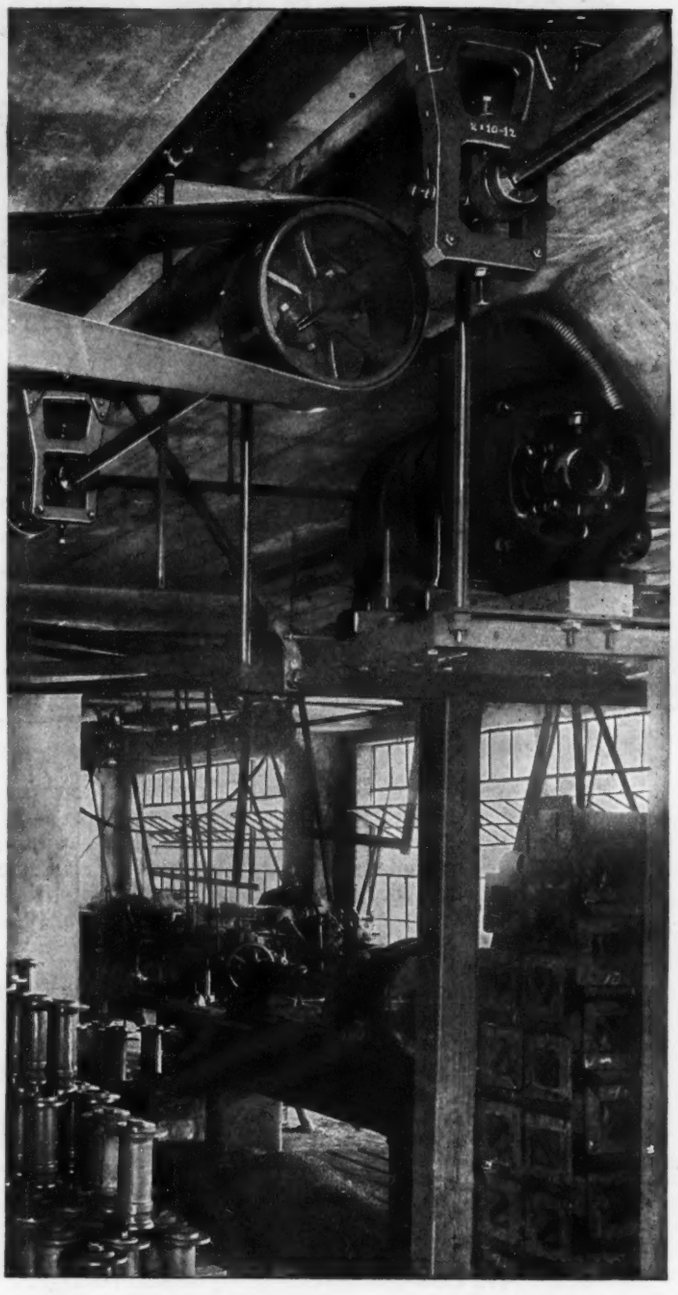
"They Gave Us Such Good Service"

"After careful investigation" writes Emil J. Paidar Co., large manufacturers of barbers' chairs and fixtures, "we finally selected the Howell Red Band Motors with anti-friction Timken Roller Bearings.

"This is not our first experience in roller bearings of the Timken type, as we have used them for years on line shafting. They gave us such good service that we put in additional equipment of the same type in our new plant, and this is one of the reasons why we selected the Howell Motors.

"We have 30 Howell Red Band Motors of the Timken type in service, ranging from 3 to 30 h. p. and are very much pleased with the service they are rendering.

"(Signed) J. R. Emmertt,
Factory Superintendent"



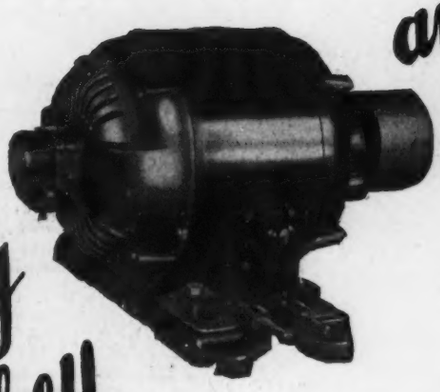
This Timken user proved to his own satisfaction that in Howell motors and Dodge line shafting, as in every other type of application, Timken Bearings mean even more than friction elimination, power economy, and minimum lubrication. Timkens also bring the extreme endurance made possible only by Timken tapered construction, Timken *POSITIVELY ALIGNED ROLLS*, and Timken-made electric steel. These features assure utmost thrust, shock and radial capacity, entirely self-contained. Timken all-around higher capacity is the strongest insurance against shut-downs and under-production.

THE TIMKEN ROLLER BEARING CO.
C A N T O N , O H I O

Technical information regarding bearing sizes and mountings is obtainable from the Timken Roller Bearing Service & Sales Company's Branches located in the following cities: Atlanta, Boston, Buffalo, Chicago, Cincinnati, Cleveland, Dallas, Denver, Detroit, Kansas City, Los Angeles, Memphis, Milwaukee, Minneapolis, Newark, New York, Omaha, Philadelphia, Pittsburgh, Richmond, St. Louis, San Francisco, Seattle, Toronto, Winnipeg

TIMKEN
Tapered
ROLLER BEARINGS

Physically They and Financially Appeal



ROBBINS and MYERS motors appeal to those who know them. Appeal physically because of their sturdiness, big oversize bronze bearings, "air breathing" cooling system.

They appeal financially because of the moderate initial cost, extraordinary long life and minimum maintenance cost.

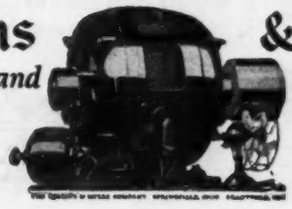
Investigate our engineering service—on any type of motor service. Then put in an R. & M. motor and watch it perform.

Robbins & Myers, Inc.

Springfield, Ohio — Brantford, Ontario

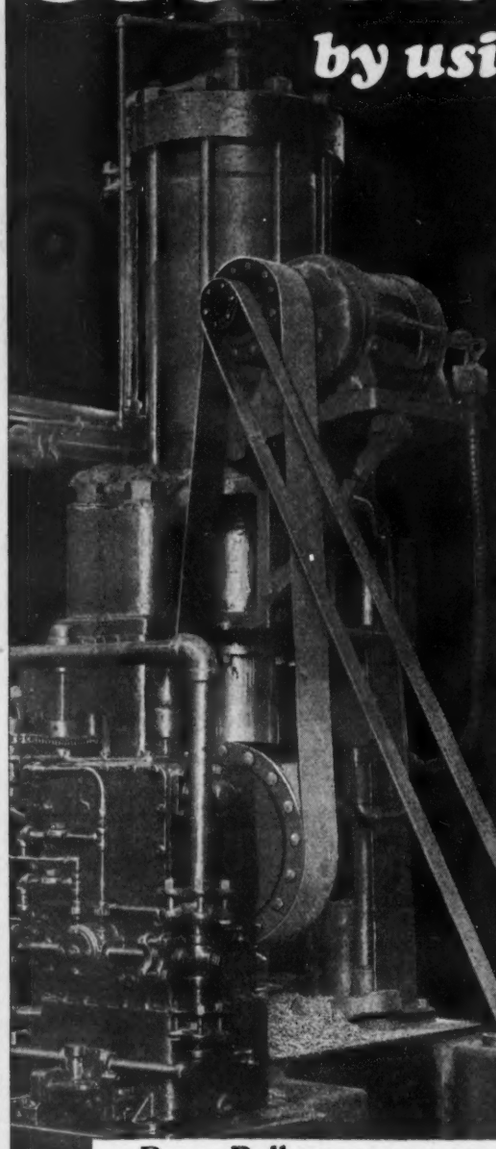
Agents in Principal Cities of the World

Robbins & Myers
Fans and Motors



STOP PROFIT LEAKS

by using PAPER Pulleys



Wherever you have a machine equipped with metal pulleys, you are certain to have *slippage*—production profits leaking away at *every* pulley surface. Metal pulleys cannot conserve power because they cannot properly GRIP the belt.

The machine pictured here came to the purchaser equipped with metal pulleys. But the purchaser knew more about pulleys than the machinery manufacturer. The slipping metal pulleys were replaced with efficient PAPER Pulleys—PULLeys that really PULL!....

RESULT: 10% GREATER DAILY PRODUCTION AT NO MORE COST.

Paper Pulleys cost no more, often less, than metal pulleys. *Get the facts—now!*

THE ROCKWOOD MANUFACTURING CO.
INDIANAPOLIS, IND.

THE OHIO VALLEY PULLEY WORKS
MAYSVILLE, KY.

Divisions of General Fibre Products, Incorporated

Rockwood Paper Pulleys INDIANAPOLIS, U.S.A.

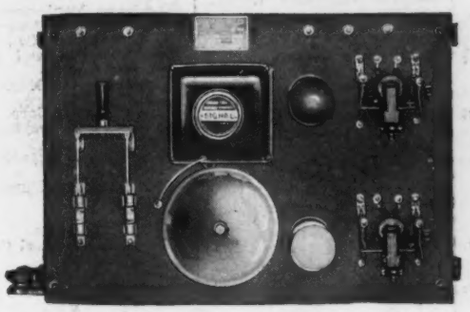
Over 2,000 stock sizes, 1½" to 14" diameter, carried by dealers from coast to coast. Larger sizes, to 72" diameter, made promptly on order.

THE OHIO VALLEY PULLEY WORKS INC. THE BROWNING FOR DURABILITY MAYSVILLE, KENTUCKY, U.S.A.

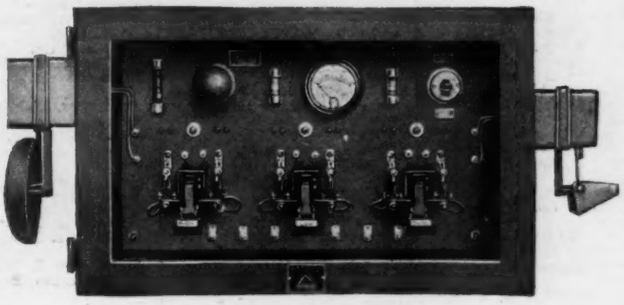
ROCKWOOD

PULLEYS THAT PULL

SUNDH HIGH and LOW SIGNAL and ALARM PANELS



For open circuit
For closed circuit



For closed circuit

These Signal and Alarm panels may be used to indicate high and low conditions of liquid level, pressure, etc. They are accurate and dependable giving audible and visual signal when extreme condition is reached.

The panel illustrated on the left is arranged so that gong may be manually silenced but is automatically made ready for service upon restoration of conditions to normal. Visual signal (light) is operative continuously.

The panel illustrated on the right provides means for continuously testing the circuits and will sound an alarm when circuit trouble develops.

Our EXPERIENCE in solving problems in control extends over 25 years. This experience is available to you. What is your problem? Let us help in its solution.

SUNDH ELECTRIC COMPANY, INC.

RELIABLE CONTROL

Parkhurst St. at Ave. C Newark, N. J., U. S. A.

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BUFFALO, John E. Hoffman, 280 Carolina St.
CHICAGO, Thos. E. Beasley, 333 No. Michigan Ave.
CINCINNATI, R. M. Heim, 2413 Union Central Bldg.
CLEVELAND, Wallene Engr'g Co., 1783 E. 11th St.
DENVER, Joy & Cox, Inc., 314 Tramway Bldg.
DETROIT, Ralph D. Ernest, 207 Coe Terminal Bldg.
KANSAS CITY, Chas. L. Ward Co., 701 Midland Bldg.
LOS ANGELES, Otto Demmert, 106 W. 3rd St.
MINNEAPOLIS, H. R. Harris, 703 6th Ave. So.
NEWARK, L. L. Wilcox, Parkhurst St. at Ave. C.
NEW ORLEANS, Lyman C. Reed, 1230 Hibernia Bank Building.
NEW YORK CITY, P. W. Moeller, 51 E. 42d St.
OMAHA, Chas. L. Ward Co., 734 Electric Bldg.
PHILADELPHIA, H. F. Darby, Jr., 1700 Walnut St.
PITTSBURGH, Rutherfoord & Uptegraff, Suite 14, New Clark Bldg.
ST. LOUIS, D. O. Stewart, 619 Bank of Com. Bldg.
SAN FRANCISCO, Oliver B. Lyman, 235 Montgomery St.
SEATTLE, Thomas S. Wood, 505 Polson Bldg.
TORONTO, CAN., D. M. Fraser, Ltd., 24 E. Adelaide St.
TULSA, E. B. Nelson (Ward Co.) 2724 E. Admiral Pl.
VANCOUVER, B. C., N. D. Blagdon Phillips, 615 Pender St. W.
EXPORT, S. A. Rapier Co., 56 Wall St., N. Y. C.

WHAT AND WHERE TO BUY

Air Preheaters
Babcock & Wilcox Co.
Blaw-Knox Co.
Combustion Engr. Corp.
Edge Moor Iron Co.
Sturtevant Co., B. F.

Air Washing and Conditioning Apparatus
Badger & Sons Co., E. B.
Sturtevant Co., B. F.

Alternators
American Brown-Boveri Elec. Corp.
Burke Elec. Co.

Anchors, Guy
Copperweld Steel Co.
Hubbard & Co.
Kearney Corp., Jas. R.
W. N. Matthews Corp.
Oliver Iron & Steel Corp.
Truscon Steel Co.

Apparatus, Experimental
Biddle, James G.

Apparatus, Testing
American Transformer Co.
Biddle, James G.

Arc Welders, Portable
Lincoln Electric Co.
Ohio Brass Co.

Asbestos
Asbestos Shingle, Slate & Sheathing Co.
Johns-Manville Corp.

Babbitts
Westinghouse Elec. & Mfg. Co.

Batteries, Control Bus
Wubco Battery Corp.

Batteries, Dry
Graybar Elec. Co.
National Carbon Co.

Batteries, Power
Wubco Battery Corp.

Batteries, Storage
Electric Storage Battery Co.
Wubco Battery Corp.

Battery Charging Apparatus
Cutler-Hammer Mfg. Co.
General Electric Co.
Wagner Electric Corp.
Ward Leonard Elec. Co.
Westinghouse Electric & Mfg. Co.

Bearings
Armature
S K. F. Industries
Timken Roller Bearing Co.
Ball
Marlin-Rockwell Co.
S K. F. Industries
Standard Steel & Bearings, Inc.
Roller
S K. F. Industries
Timken Roller Bearing Co.
Thrust
S K. F. Industries
Smith Co., S. Morgan
Timken Roller Bearing Co.

Bells, Conduit
G. & W. Electric Spec. Co.

Blocks, Fuse
Westinghouse Elec. & Mfg. Co.

Blowers
American Brown Boveri Elec. Corp.
Sturtevant Co., B. F.

Boiler Room Instruments (See Instruments)

Boilers
Water Tube
Babcock & Wilcox Co.
Combustion Eng. Corp.
Edge Moor Iron Co.
Heine Boiler Co.
Ladd Water Tube Boiler Co.

Bolts
Carriage
Hubbard & Co.
Oliver Iron & Steel Corp.
Crossarm
Hubbard & Co.
Oliver Iron & Steel Corp.
Expansion
Hubbard & Co.
Oliver Iron & Steel Corp.
Machine
Hubbard & Co.
Oliver Iron & Steel Corp.

Bonds, Rail
Copperweld Steel Co.
Ohio Brass Co.

Boosters
General Electric Co.
Westinghouse Electric & Mfg. Co.

Boxes
Fuse
G & W Elec. Spec. Co.
General Electric Co.
Metropolitan Devices Co.
Schweitzer & Conrad, Inc.
Junction and Outlet
G & W Elec. Spec. Co.
General Electric Co.
Westinghouse Electric & Mfg. Co.
Meter and Service
General Electric Co.
Metropolitan Device Corp.
Switch
Colt's Patent Fire Arms Mfg. Co.
Underground Junction
Colt's Patent Fire Arms Mfg. Co.

Braces, Crossarm
Hubbard & Co.
Oliver Iron & Steel Corp.
Truscon Steel Co.

Brackets and Pins, Metal
Allis-Chalmers Mfg. Co.
Hubbard & Co.
Oliver Iron & Steel Corp.

Brakes
Cutler-Hammer Mfg. Co.
Electric Controller & Mfg. Co.

Breechings
Connery & Co.

Brushes, Carbon
National Carbon Co.
Speer Carbon Co.

Brushes, Dynamo & Carbon
Morganite Brush Co.

Buckets
Mead-Morrison Mfg. Co.

Buckets, Clamshell
Blaw-Knox Co.
Link-Belt Co.

Buildings
Steel
Bates Steel Corp., Walter
Blaw-Knox Co.
Delta-Star Electric Co.
Truscon Steel Co.

Bus Bars & Bus Tubes
American Brass Co.

Bus Bars, Aluminum
Aluminum Co. of Amer.

Bus Bar Supports
Delta Star Elec. Co.
Electric Power Equip. Corp.
General Electric Co.
Hivoltage Equipment Co.
Ohio Brass Co.
Railway & Industrial Eng. Co.
Schweitzer & Conrad, Inc.
Westinghouse Elec. & Mfg. Co.

Bus Structures
Bus Structure Co., The

Cable Accessories, End Bells and Racks
Truscon Steel Co.

Cable (See Wires & Cables)

Cable Machinery
American Ins. Machy. Co.

Cable Boxes, Underground
G. & W. Elec. Spec. Co.

Cable Racks, End Bells and Accessories
Electrical Engineers Equip. Co.
G & W Elec. Spec. Co.
Hubbard & Co.
Metropolitan Device Co.
Oliver Iron & Steel Corp.
Philadelphia Elec'l & Mfg. Co.
Standard Underground Cable Co.

Cable Splicing Material
G. & W. Elec. Spec. Co.

Cable Taps, Solderless
Dossert & Co.

Caps, Ground
Hubbard & Co.
Oliver Iron & Steel Corp.

Caps, Insulator
Brewer-Titchener Corp., The

Carbonization Equipment, Low Temperature
International Coal Carbonization Co.

Castings, Heat-Resisting
Driver-Harris Co.

Catenary Trolley Materials
Ohio Brass Co.

Cell Structures
Deceleco, Inc.

Choke Coils
Hi-Voltage Equipment Co.

Circuit Breakers
Anderson Mfg. Co. A. & J. M.
Condit Elec'l. Mfg. Co.
General Electric Co.
Roller-Smith Co.
Schweitzer & Conrad, Inc.
Sundh Electric Co.
Ward Leonard Elec. Co.
Westinghouse Elec. & Mfg. Co.

Cement, High Temperature
Johns-Manville Corp.

Clamp Pins, Way
St. Louis Malleable Iron Casting Co.

Clamps
Cable Supporting
Matthews Corp., W. N.
Truscon Steel Co.
Ground Connection
Copperweld Steel Co.
General Electric Co.
Railway & Industrial Engr. Co.
Sherman Mfg. Co., H. B.
Guy
Hubbard & Co.
Matthews Corp., W. N.
Oliver Iron & Steel Corp.
Trolley
Ohio Brass Co.
Wire
Wire-Lock Clamp Co.

Cleats
Blake Signal & Mfg. Co.
Thomas & Sons Co., R.

Clevises
Hubbard & Co.
Oliver Iron & Steel Corp.

Clips, Cable
Hubbard & Co
Oliver Iron & Steel Corp.

Clutches, Friction
Link-Belt Co.

Clutches, Magnetic
Cutler-Hammer Mfg. Co.

Coal and Ash Handling Machinery
Link-Belt Co.

Coal Storage Systems
Link-Belt Co.

Coils
Armature, Field and Magnet
Acme Wire Co.
Belden Mfg. Co.
General Electric Co.
Choke
Delta Star Elec. Co.
Dudlo Mfg. Co.
General Electric Co.
Hi-Voltage Equip. Co.
Railway & Industrial Eng. Co.
Schweitzer & Conrad, Inc.
Westinghouse Elec. & Mfg. Co.
Magnet
Dudlo Mfg. Co.
Pipe
Superheater Co.
Reactance
American Transformer Co.
Transformer
Dudlo Mfg. Co.

Coke Quenching Systems
Dry Quenching Eqpt. Corp.

Compensators, Starting
American Transformer Co.

Compressors, Air
Allis-Chalmers Mfg. Co.
Cameron Steam Pump Works, A. S.
General Electric Co.
Ingersoll-Rand Co.
Westinghouse Elec. & Mfg. Co.
Worthington Pump & Machy. Corp.
Turbo
American Brown-Boveri Elec. Corp.
Cameron Steam Pump Works, A. S.
Ingersoll-Rand Co.

Concrete Armoring Surface
Irving Iron Works

Condenser Tubes
American Brass Co.

Condensers
Coil
Superheater Co.
Static
Electric Machy. Mfg. Co.
Sangamo Electric Co.
Westinghouse Elec. & Mfg. Co.
Steam
Allis-Chalmers Mfg. Co.
Cameron Steam Pump Works, A. S.
Ingersoll-Rand Co.
Westinghouse Elec. & Mfg. Co.
Wheeler Mfg. Co., C. H.
Worthington Pump & Machy. Corp.

Conduit
Clay
Clay Products Co.
Fibre
Fibre Conduit Co.
Johns-Manville Corp.
Flexible, Steel
General Electric Co.
Interior
Johns-Manville Corp.
Rigid, Aluminum
Aluminum Co. of America
Rigid, Steel
General Electric Co.
Underflow
Fibre Conduit Co.
Underground
Johns-Manville Corp.

Conduit Fittings
Erie Malleable Iron Co.

Connectors
Burndy Engineering Co., Inc.
Hivoltage Equipment Co.

Connectors and Terminals
Sherman Mfg. Co., H. B.

Connectors, Solderless
Dossert & Co.
Kearney Corp., Jas. R.

Connectors and Terminals
Electric Power Equip. Corp.
General Electric Co.
Railway & Industrial Engr.
Westinghouse Elec. & Mfg. Co.

Contact Rail Material
Electric Service Supplies Co
Ohio Brass Co.

Contactors
Electric Controller & Mfg. Co.

Contractors, Transmission Line
Hoosier Engineering Co.

Control, Electric Valve
Cutler-Hammer Mfg. Co. (Dean)

Control Railway
Westinghouse Elec. & Mfg. Co.

Control Systems
Electric Controller & Mfg. Co.
Ward Leonard Elec. Co.
Combustion
Smoot Engrg. Corp.

Controllers
Electric Automatic
Cutler-Hammer Mfg. Co.
Monitor Controller Co.
Ward Leonard Elec. Co.
Motor
Cutler-Hammer Mfg. Co.
Electric Machy. Mfg. Co.
General Electric Co.
Industrial Controller Co.
Monitor Controller Co.
Sundh Electric Co.
Union Elec. Mfg. Co.
Westinghouse Elec. & Mfg. Co.
Rheostatic
Monitor Controller Co.
Ward Leonard Elec. Co.
Speed
Monitor Controller Co.
Ward Leonard Elec. Co.

Converters
Allis-Chalmers Mfg. Co.
American Brown-Boveri Elec. Corp.
Booster
Westinghouse Elec. & Mfg. Co.
Wagner Electric Corp.
Synchronous
Westinghouse Elec. & Mfg. Co.

Conveying Machinery (Coal, Ashes, etc.)
Link-Belt Co.

Conveyors, Ash
Combustion Engr. Corp.

Conveyors, Belt
Link-Belt Co.

Coolers
Air
Griscom-Russell Co., The
Oil
Griscom-Russell Co., The

Generator
Sturtevant Co., B. F.

Cord
Arc Lamp
Simplex Wire & Cable Co.
Flexible
Rome Wire Co.
Portable Rubber Covered
Simplex Wire & Cable Co.

Cords and Cables, Flexible
Okonite Co.
Simplex Wire & Cable Co.

Couplings, Flexible
Bartlett-Hayward Co.
Falk Corp., The

Crane Motors
General Electric Co.
Star Electric Motor Co.
Westinghouse Elec. & Mfg Co.

Cranes, Electrical
Shepard Elec. Crane & Hoist Co.

Cranes, Locomotive
Link-Belt Co.

Cranes, Travelling
Shepard Elec. Crane & Hoist Co.

Cross Arms
Graybar Elec. Co.
Hubbard & Co.
Oliver Iron & Steel Corp.
Philadelphia Elec'l & Mfg. Co.
Porter & Ross, Inc.
Railway & Industrial Eng Co.
Thomas & Sons Co., R.
Truscon Steel Co.
Creosoted Southern Pine
International Creosote & Constr. Co.
Steel
Bates Steel Corp., Walter

Crucibles, Carbon
Globar Corp.

Crushers, Coal and Coke
American Pulverizer Co.
Link-Belt Co.

Cutouts
Bowie Switch Co.
Colt's Patent Fire Arms Mfg. Co.
General Electric Co.
Matthews Corp., W. N.
Metropolitan Device Corp.
Westinghouse Elec. & Mfg Co.
High Tension
High Tension Elec. Spec. Co.

Schweitzer & Conrad, Inc
Plug
Kearney Corp., Jas. R.
Series
G. & W. Elec. Spec. Co.
Transformer
Wagner Electric Corp.

De-Superheaters, Steam
Superheater Co.

Disconnectors
Gang
Hivoltage Equipment Co.
Hook
Hivoltage Equipment Co.

Distilling Plants, Boiler Feed
Griscom-Russell Co., The

Doors for Bin and Switch Compartments
Cutler-Hammer Mfg. Co.
Deceleco, Inc.
Johns-Manville Corp.

Drafting and Surveying Supplies
Dietzgen Co., Eugene

Drills, Rock
Cameron Steam Pump Works, A. S.
Hubbard & Co.
Ingersoll-Rand Co.
Oliver Iron & Steel Corp.

Economizers
Babcock & Wilcox Co.
Sturtevant Co., B. F.

Ejectors
Westinghouse Elec. & Mfg. Co.

Electric Railway Materials
Ohio Brass Co.

Electrification Materials, Steam Road
Ohio Brass Co.

Enameling Machinery, Wire
American Insulating Machinery Co.

Engineers and Contractors
Ford, Bacon & Davis

Engineers, Transmission Line
Hoosier Engineering Co.

Engines
Diesel
Lombard Governor Co., The
Worthington Pump & Machy. Corp.
Gas
Allis-Chalmers Mfg. Co.
Worthington Pump & Machy. Corp.
Oil
Cameron Steam Pump Works, A. S.
Ingersoll-Rand Co.
Lombard Governor Co., The
Steam
Allis-Chalmers Mfg. Co.
American Brown-Boveri Elec. Corp.
Sturtevant Co., B. F.

Equipment
High Tension
Line Material Co.
Ohio Brass Co.
Schweitzer & Conrad, Inc.
Switching
Kearney Corp., Jas. R.
Underground
Line Material Co.

Erectors, Transmission Line
Hoosier Engineering Co.

Evaporators, Water
Griscom-Russell Co., The

Exchangers, Heat
Superheater Co.

Fan Motors
Century Electric Co.
Electric Machy. Mfg. Co.
General Electric Co.
Peerless Electric Co.
Robbins & Myers, Inc.
Westinghouse Elec. & Mfg Co.

Fans
Exhaust and Ventilating
Century Electric Co.
General Electric Co.
Robbins & Myers, Inc.
Sturtevant Co., B. F.
Wagner Electric Corp.
Westinghouse Elec. & Mfg. Co

Fault Locators
Matthews Corp., W. N.

Fence, Woven Wire
Copperweld Steel Co.
Page Steel & Wire Co.

Financial
Electric Bond & Share Co.
Pynchon & Co.

Flashlights
National Carbon Co.

Flooring, Open Steel
Blaw-Knox Co.
Irving Iron Works

Flooring, Steel
Blaw-Knox Co.
Irving Iron Works

Furnace Walls, Water Cooler
Superheater Co.

Furnaces
Electric
American Brown-Boveri Elec. Corp.

The saviours of electric traction

ACCORDING to no less an authority than Elihu Thomson, "no single thing had a greater or more direct influence upon the technical success of electric railway machinery than the introduction of the carbon brush as a substitute for the various forms of metal brush." This tribute is, we believe, no less deserved for the entire electrical field than it is for the traction industry. It is true that for certain applications the metal brush has returned, but in considerably modified form, containing considerable carbon; carbon therefore did not merely displace metal brushes, but also brought them back into practicality.

Writing of the early metal brushes on railway motors, Thomson stated: "They were only calculated, under the harsh conditions, to be ground, and to grind the commutator, into dust at a rapid rate (such dust being scattered by the pound along the line of way) with the production at the same time of a flickering greenish illumination under the car, an illumination all the more ghastly on account of the havoc known to be going on and of which it was an unfailing index."

Such conditions made the future of electric railways exceedingly doubtful, as they did that of all other electrical machines of any size. In 1888 Chas. J. Van Depoele suggested trial of a plate of carbon as a brush on railway motors, such a plate having been used successfully on stationary motors. The new carbon brush made its virtues evident immediately. Crude though they were, the early carbon brushes saved the traction industry. One of the first of these was inspected after a run of 5000 miles, when it showed moderate wear, and the commutator none.

The new brushes were quickly applied to motors and generators everywhere. In America, the first brushes to find commercial use were made by the National Carbon Company in 1887. Continuously since then this company has co-operated with manufacturers of electrical machinery in the development of proper brushes.

NATIONAL CARBON COMPANY, INC.

Unit of Union Carbide UCC *and Carbon Corporation*

Carbon Sales Division

Cleveland, Ohio — SILVER STRAND CABLE TRADE MARK REGISTERED — San Francisco, Cal.

Branch Offices and Factories

CHICAGO, ILL. PITTSBURGH, PA. JERSEY CITY, N. J. BIRMINGHAM, ALA.

Combustion Engr. Corp.
Detroit Electric Furnace Co
Pittsburgh Elec. Furnace
Corp.
Electric Steel Melting
American Bridge Co.
Fuse Plugs
Delta Star Elec. Co.
Fuses
High Tension
Bowie Switch Co.
Colt's Patent Fire Arms Mfg. Co.
Delta Star Elec. Co.
Electrical Engineers' Equip Co.
General Electric Co
Hi-Voltage Equipment Co.
Line Material Co.
Matthews Corp., W. N.
Schweitzer & Conrad, Inc.
Westinghouse Elec. & Mfg Co.
Refillable
Colt's Patent Fire Arms Mfg. Co.
Renewable
Colt's Patent Fire Arms Mfg. Co.
Westinghouse Elec. & Mfg Co.
Standard
Condit Elec'l. Mfg. Co.
General Electric Co.
Graybar Elec. Co.
Metropolitan Device Corp.
Westinghouse Elec. & Mfg Co.
Galvanizing
Hubbard & Co.
Lehigh Structural Steel Co.
Galvanizing, Hot Dip
Bates Expanded Steel Truss Co.
Cattie & Bros., Jos. P.
Newport News Shipb'ld'g & Drydock Co.
Gates, Head & Sluice
Smith Co., S. Morgan
Newport News Shipping & Drydock Co.
Gauges, Recording
Bristol Co., The
Gearing, Silent and Flexible
Link-Belt Co.
Gears
Celoron Co., The
Falk Corp., The
General Electric Co.
Westinghouse Elec. & Mfg. Co.
Generating Sets
Direct Connected
Electric Machy. Mfg. Co.
Westinghouse Elec. & Mfg. Co.
Geared
Westinghouse Elec. & Mfg. Co.
Motor
Allis-Chalmers Mfg. Co.
Burke Electric Co.
Electric Machy. Mfg. Co.
General Electric Co.
Wagner Electric Corp.
Westinghouse Electric & Mfg. Co.
Turbine Driven
Sturtevant Co., B. F.
Westinghouse Elec. & Mfg. Co.
Generators
Allis-Chalmers Mfg. Co.
Electric Machy. Mfg. Co.
Star Electric Motor Co.
Sturtevant Co., B. F.
Westinghouse Elec. & Mfg. Co.
Motor
American Brown-Boveri Elec. Corp.
Steam
Babcock & Wilcox Co.
Combustion Engineering Corp.
Turbo
American Brown-Boveri Elect. Corp.
Water Wheel
American Brown-Boveri Elect. Corp.
Governors
Pelton Water Wheel Co.
Mechanical
Lombard Governor Co., The
Woodward Governor Co.
Hydraulic
Woodward Governor Co.
Grating, Steel
Blaw-Knox Co.
Irving Iron Works
Ground Caps
G. & W. Elec. Spec. Co.
Ground Rods
Copperweld
Copperweld Steel Co.
Hubbard & Co.
Galvanized
Hubbard & Co.
Grounds, Etc.
Paragon Electric Co.
Truscon Steel Co.
Guards, Lamp
Matthews Corp., W. N.
Hangers, Ball Bearing
S K. F. Industries
Hangers, Cable
Hubbard & Co.
Hardware, Insulator
Ohio Brass Co
Oliver Iron & Steel Corp.
Truscon Steel Co.
Hardware, Pole Line
Ohio Brass Co.
Oliver Iron & Steel Corp.
Porter & Ross, Inc.
Truscon Steel Co.
Headlights, Arc and Incan.
Ohio Brass Co.
Heaters
Air
Air Preheater Corp.
Electric Water
Automatic Electric Heater Co.
Feed Water
Griscom-Russell Co., The
Sturtevant Co., B. F.
Westinghouse Elec. & Mfg. Co.
Worthington Pump & Machy. Corp.
Heating Devices
Cutler-Hammer Mfg. Co.
General Electric Co.
Graybar Elec. Co.
Westinghouse Elec. & Mfg. Co.
Heating Elements, Non-Metallic—Industrial and Domestic
Globar Corp.
High Tension Materials
Ohio Brass Co.
Hoists
Electrical
Allis-Chalmers Mfg Co.
American Engineering Co.
Link-Belt Co.
Shepard Elec. Crane & Hoist Co.
Yale & Towne Mfg. Co.
Headgate
Newport News Shipping & Drydock Co.
Smith Co., S. Morgan
Steam
Allis-Chalmers Mfg. Co
Cameron Steam Pump Works, A. S.
Ingersoll-Rand Co.
Link-Belt Co.
Impregnation
Tar Products Corp.
Indicators, Transformer Load
Westinghouse Elec. & Mfg. Co.
Industrial Lighting Fixtures
Philadelphia Elec'l & Mfg. Co.
Inspections and Tests
Electrical Testing Laboratories
Instrument Transformers
General Electric Co.
Instruments
Boiler Room
Bristol Co., The
General Electric Co.
Electrical
Biddle, James G.
Bristol Co., The
General Electric Co.
Roller-Smith Co.
Sangamo Electric Co.
Weston Elecl. Instr. Corp.
Graphic
Biddle, James G.
Bristol Co., The
General Electric Co
Westinghouse Elec. & Mfg. Co.
Indicating
General Electric Co.
Roller-Smith Co.
Westinghouse Elec. & Mfg. Co.
Weston Elecl. Instr. Corp.
Integrating
General Electric Co.
Sangamo Electric Co.
Portable
Roller-Smith Co.
Westinghouse Elec. & Mfg. Co
Recording
Bristol Co., The
Landis & Gyr, Ltd.
Westinghouse Elec. & Mfg. Co.
Scientific and Testing Service
Biddle, James G.
Bristol Co., The
General Electric Co.
Metropolitan Device Corp.
Roller-Smith Co.
Sangamo Electric Co.
Westinghouse Elec. & Mfg. Co.
Weston Elecl. Instr. Corp.
Transformer
Roller-Smith Co.
Insulating Machines, Rubber
Royle & Sons, John
Insulating Machinery, Wire
American Insulating Machinery Co.
Insulating Material
Asbestos Ebony
Deceleco, Inc.
Johns-Manville Corp.
Composition Cloth & Paper
Irvington Varnish & Ins. Co.
Mica Insulator Co.
Westinghouse Elec. & Mfg. Co.
Compounds, Paints and Varnishes
Celoron Co., The
Garfield Mfg. Co.
General Electric Co.
Irvington Varnish & Ins. Co.
Mica Insulator Co.
Westinghouse Elec. & Mfg. Co.
Custom Molded
Colt's Patent Fire Arms Mfg. Co.
Fiber
West Virginia Pulp & Paper Co.
Laminated Phenolic Condensation Products
Celoron Co., The
Lava
Steward Mfg. Co., D. M.
Mica
Mica Insulator Co.
Munsell & Co., Eugene
Mica, Micarata
Westinghouse Elec. & Mfg. Co.
Molded
Bakelite Corp.
Cutler-Hammer Mfg. Co.
Garfield Mfg. Co.
Insulation Mfg. Co.
Westinghouse Elec. & Mfg. Co.
Paper
Irvington Varnish & Ins. Co.
Porcelain
Ohio Brass Co.
Silk
Irvington Varnish & Ins. Co.
Slate
Portland-Monson Slate Co.
Tape and Webbing
General Electric Co.
Mica Insulator Co.
Westinghouse Elec. & Mfg. Co.
Transite
Deceleco, Inc.
Treated Fabric and Paper
Acme Wire Co.
Wire Covering
Tar Products Corp.
Insulation, Electric
Bakelite Corp
Celoron Co., The
West Virginia Pulp & Paper Co.
Insulation, Molded
Bakelite Corp.
Insulator Equipment
Thomas & Sons Co., R.
Insulator Pins
Hubbard & Co.
Ohio Brass Co.
Oliver Iron & Steel Corp.
Philadelphia Elec'l & Mfg. Co.
Thomas & Sons, R.
Insulators
High Voltage Porcelain
Canadian Porcelain Co., Ltd.
Electric Service Supplies Co.
Franklin Porcelain Co.
Locke Insulator Corp.
Ohio Brass Co.
Porcelain Insulator Corp.
Glass
Hemingray Glass Co.
Pin Type
Ohio Brass Co.
Porcelain Insulator Corp.
Railway & Industrial Engr. Co.
Porcelain
Canadian Porcelain Co., Ltd.
Cook Porcelain Insulator Corp.
Insulation Mfg. Co.
Ohio Brass Co.
Porcelain Insulator Corp.
Porcelain Composition
General Porcelain Co.
Lapp Insulator Co., Inc.
Ohio Brass Co.
Thomas & Sons Co., R.
Westinghouse Elec. & Mfg. Co.
Porcelain and Composition
Illinois Electric Porcelain Co.
Jeffery-Dewitt Inc. Co.
Post Type
Delta Star Elec. Co.
Irons, Electric
Westinghouse Elec. & Mfg. Co.
Joints, Expansion
Badger & Sons Co., E. B.
Laboratories
Electrical Testing Laboratories
Lamps
Arc
General Electric Co.
Westinghouse Elec. & Mfg. Co.
Incandescent
Graybar Elec. Co.
Westinghouse Elec. & Mfg. Co.
Miniature
General Electric Co.
Lamp Guards
Matthews Corp., W. N.
Lamp Replacers
G. C. A. Mfg. Co.
Matthews Corp., W. N.
Lightning Arresters
Hivoltage Equipment Co.
Lighting Equipment and Accessories
Hubbard & Co.
Wheeler Reflector Co.
Lighting Equipment, Interior and Exterior
Holophane Glass Co.
Westinghouse Elec. & Mfg. Co.
Wheeler Reflector Co.
Lighting Fixtures, Outdoor
Line Material Co.
Lighting Standards
Bates Steel Corp., Walter
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Truscon Steel Co.
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Delta Star Elec. Co.
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Electric Service Supplies Co.
Electrical Engineers' Equip. Co.
General Electric Co.
Hi-Voltage Equipment Co.
Hubbard & Co.
Railway & Indus. Engr. Co.
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Westinghouse Elec. & Mfg. Co.
Line Material
Electric Service Supplies Co.
G & W Elec. Spec. Co.
General Electric Co.
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Line Material Co.
Ohio Brass Co.
Oliver Iron & Steel Corp.
Truscon Steel Co.
Westinghouse Elec. & Mfg. Co
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Copperweld Steel Co.
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Linemen Protector Co.
Linemen's Supplies and Tools
Leach Co.
Linemen Protector Co.
Locaters, Fault
Lundin Elec. & Mach. Co.
Matthews Corp., W. N.
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Amer. Brown-Boveri Elec. Corp.
Locomotives, Electric
American Brown-Boveri Elec. Corp.
Westinghouse Elec. & Mfg. Co.
Lubricants
Vacuum Oil Co.
Lumber Creosoted Southern Pine
International Creosote & Constr. Co.
Machinery, Armature Repair
Electric Service Supplies Co.
Machines
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Allis-Chalmers Mfg. Co.
Welding
Westinghouse Elec. & Mfg. Co.
Machines, Billing
Remington Rand Business Service, Inc.
Machines, Bookkeeping
Remington Rand Business Service, Inc.
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Electric Controller & Mfg. Co.
Metal, Non-Corrosive
International Nickel Co.
Meters
Demand
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Sangamo Electric Co.
Westinghouse Elec. & Mfg. Co.
Kilovoltamperes
Landis & Gyr, Ltd.
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Tanner Engr. Co.
Remote Indicating
Tanner Engr. Co.
Watthour
Duncan Electric Mfg. Co.
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Sangamo Electric Co.
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Garfield Mfg. Co
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Celoron Co., The
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Baldor Electric Co.
Burke Elec. Co.
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Crocker-Wheeler Electric Mfg. Co.
General Electric Co.
Graybar Elec. Co.
Lincoln Electric Co.
Marble Card Elec. Co., The
Peerless Electric Co.
Robbins & Myers, Inc.
Star Electric Motor Co.
Sturtevant Co., B. F.
Wagner Electric Corp.
Westinghouse Elec. & Mfg. Co.
Zobell Elec. Motors Co.
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Electric Machy. Mfg. Co.
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Vacuum Oil Co.
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General Electric Co.
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Westinghouse Elec. & Mfg. Co.
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Alberene Stone Co.
Panels, Switchboard
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Westinghouse Elec. & Mfg. Co.
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Ingersoll-Rand Co.
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Penstocks
Newport News Shipping & Drydock Co.
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States Co., The
Piling, Creosoted Southern Pine
International Creosote & Const. Co.
Pins, Insulator
Hubbard & Co.
Ohio Brass Co.
Oliver Iron & Steel Corp.
Pins, Thru
St. Louis Malleable Iron Casting Co.
Pipe
Riveted Steel
Newport News Shipping & Drydock Co.
Riter-Conley Co
Pipe Frame Fittings, Electrical
Schweitzer & Conrad, Inc.
Westinghouse Elec. & Mfg Co.
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General Electric Co.
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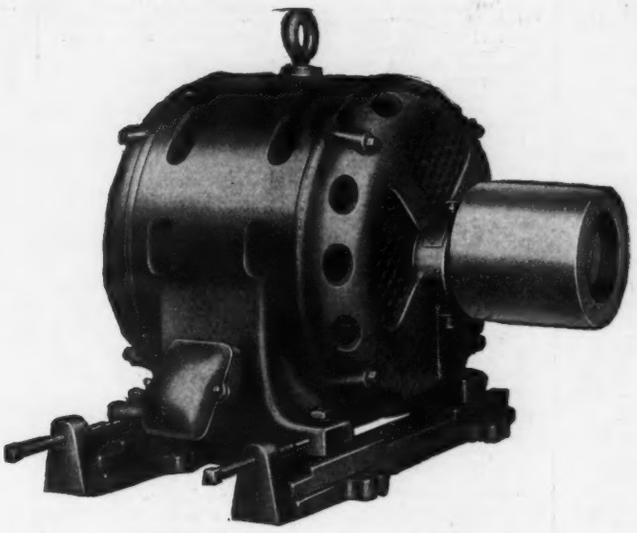
Pole Cradle
Farnham & Cunningham
Pole Line Hardware
Electric Service Supplies Co.
Graybar Elec. Co.
Hubbard & Co.
Malleable Iron Fittings Co.
Ohio Brass Co.
Oliver Iron & Steel Corp.
Truscon Steel Co.
Westinghouse Elec. & Mfg Co.
Pole Mounts
Malleable Iron Fittings Co.



30 Horse Power Century Type AS
Automatic Start Induction 3 and 2 Phase Motor

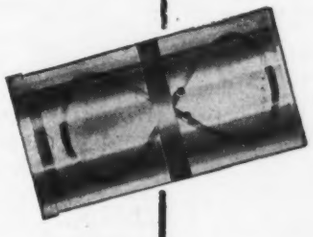
Full Load Running Fuses Can Be Used for Starting

Because of the low starting current of Century Type AS Automatic Start Induction 3 and 2 Phase Motors, regular operating fuses are usually of ample capacity to carry the full-load starting current. This feature gives added protection to the motor when unusually heavy loads occur. Should one fuse blow, the others are of such capacity that they will also blow—all phases of the motor are therefore protected.

No elaborate starting equipment is required. Any approved single-throw switch may be used for starting—making these motors particularly suited to all remote control or automatic start installations.

Built in standard sizes from ½ to 60 horse power

Bearings are long-lived—they are machined from phosphor bronze castings, the best bearing material obtainable.



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1806 Pine St. St. Louis, Mo.

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Truscon Steel Co.
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Carney & Co., B. J.
Naugle Pole & Tie Co.
Page & Hill Co.
Porter & Ross, Inc.
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Chestnut
Frankfort Lumber Co.
Creosoted Southern Pine
Brown & Sons Lumber Co., Inc., W. P.
Graybar Elec. Co.
International Creosot. & Constr. Co.
Long-Bell Lumber Co.
Texas Creosoting Co.
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Archbold-Brady Co.
Bates Expanded Steel Truss Co.
Bates Steel Corp., Walter
Lehigh Structural Steel Co.
Truscon Steel Co.
Wood
American Creosoting Co.
Hubbard & Co.
Texas Creosoting Co.
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Highway Trailer Co.
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Long-Bell Lumber Co.
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Naugle Pole & Tie Co.
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Biddle, James G.
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Ohio Brass Co.
Railway & Industrial Engr. Co.
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Blaw-Knox Co.
Sturtevant Co., B. F.
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Curtin-Howe Co.
Projectors, Floodlighting
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Condit Elec'l. Mfg. Co.
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General Electric Co.
Metropolitan Device Corp.
Railway & Industrial Eng. Co.
Roller-Smith Co.
Schweitzer & Conrad, Inc.
Westinghouse Elec. & Mfg. Co.
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Mead-Morrison Mfg. Co.
Pullers, Fuse Plug
G. C. A. Mfg. Co.
Pulleys, Paper
Rockwood Mfg. Co. (Ohio Valley Pulley Works)
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American Pulverizer Co.
Combustion Engr. Corp.
Riley Stoker Corp.
Pulverizers
Raymond Bros. Impact Pulv. Co.
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Cameron Steam Pump Works, A. S.
Ingersoll-Rand Co.
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Boiler Feew
Cameron Steam Pump Works, A. S.
Ingersoll-Rand Co.
Centrifugal
Allis-Chalmers Mfg. Co.
Cameron Steam Pump Works, A. S.
Ingersoll-Rand Co.
Pelton Water Wheel Co.
Wheeler Mfg. Co., C. H.
Worthington Pump & Machy. Corp.
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Allis-Chalmers Mfg. Co.
Vacuum
Wheeler Mfg. Co., C. H.
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Bristol Co., The
Superheated Steam
Superheater Co.
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G. & W. Elec. Spec. Co.
Racks, Intake
Newport News Shipb'ld'g & Drydock Co.
Racks, Secondary
Hubbard & Co.
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Porter & Ross, Inc.
St. Louis Malleable Iron Casting Co.
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General Electric Co.
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Copperweld Steel Co.
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Falk Corp., The
Reels, Take Up and Pay Out
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States Co., The
Resistance Units
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General Electric Co.
Globar Corp.
Railway & Industrial Eng. Co.
Ward Leonard Elec. Co.
Resistances, Lightning Arrester
Globar Corp.
Resistors
Ward Leonard Elec. Co.
Westinghouse Elec. & Mfg. Co.
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Superheater Co.
Rheostats
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Monitor Controller Co.
Sundh Electric Co.
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Copperweld Steel Co.
Hubbard & Co.
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Archer & Baldwin, Inc.
Belyea Co., Inc.
Consolidated Prod. Co.
Electric Service Co., Inc., The (Cinn. O.)
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Hall & Co., Inc., Stephen
Remphill & Co., J. L.
Land, L. J.
Myerson, Joseph
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Nussbaum & Co., V. M.
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Randle Machy. Co.
Ross Power Equip. Co,
Sachsenmaier Co., George
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Hubbard & Co.
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Matthews Corp., W. N.
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Philadelphia Elec'l & Mfg. Co.
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Star Electric Motor Co.
Westinghouse Elec. & Mfg. Co.
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Copperweld Steel Co.
Hubbard & Co.
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Cutler-Hammer Mfg. Co.
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General Electric Co.
Industrial Controller Co.
Monitor Controller Co.
Sundh Electric Co.
Ward Leonard Elec. Co.
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Alloy
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Timken Roller Bearing Co.
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Special Analysis
Timken Roller Bearing Co.
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Steel Fabrication
Bates Steel Corp., Walter
Steel Plate Work
Blaw-Knox Co.
Newport News Shipping & Drydock Co.
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Irving Iron Works
Steps, Safety Stair
Irving Iron Works
Stokers
Babcock & Wilcox Co.
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General Electric Co.
Riley Stoker Corp.
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Sub-Stations, Outdoor
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Electrical Engineers' Equip. Co.
General Electric Co.
Hi-Voltage Equipment Co.
Lehigh Structural Steel Co.
Railway & Industrial Eng. Co.
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Truscon Steel Co.
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Alberene Stone Co.
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General Electric Co.
Hi-Voltage Equip. Co.
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Champion Switch Co.
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General Electric Co.
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Railway & Industrial Engr. Co.
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Amer. Brown-Boveri Elec. Corp.
Condit Elec'l. Mfg. Co.
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Sangamo Electric Co.
Sundh Electric Co.
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States Co., The
Test Tables, Meter
States Co., The
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Timber, Creosoted Southern Pine
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Tools, Live Line
Tip's Tool Co., Inc.
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Blaw-Knox Co.
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Newport News Shipping & Drydock Co.
Riter-Conley Co.
Truscon Steel Co.
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General Electric Co.
Kuhlman Electric Co.
Moloney Electric Co.
States Co., The
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Trimmers, Tree
Bartlett Mfg. Co.
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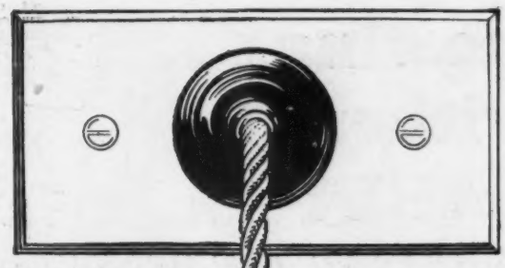
Timken Roller Bearing Co.



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Safeguarding the Mutual Interests of Suppliers of Electric Power and Radio Set Owners

ALREADY in several million homes A. C. Radio Receiving Sets are connected to the lighting socket—deriving their entire power supply from the same circuits which feed the home lighting system, electric washer, refrigerator, vacuum cleaner and many other electric devices of household necessity.

Electric Light and Power Companies everywhere are giving heed to the new service problems which have accompanied this sudden and wide-spread addition of A. C. radio sets on their distribution lines. For a long time to come adequate testing equipment for radio servicing must be employed or sponsored by Central Station Companies to guarantee their customers satisfactory radio operation and reception.

Standing between the service of A. C. power supply and millions of meter subscribers—constituting a supreme court of authority—are the three Weston instruments shown herewith.

Model 537 A. C.—D. C. Set Tester

A complete servicing outfit that will quickly diagnose the trouble in any type of radio receiver set made—without need for any additional equipment. The meters provided are equivalent to ten instruments:—a 3-range A. C. Voltmeter, 150/8/4 volts; a D. C. Volt-Milliammeter with five voltage ranges —600/300/120/60/8 volts (all 1000 ohms per volt); and two current ranges—150/30 milliamperes.

With this Weston Set Tester filament, grid, plate and cathode voltages are determined under actual operating conditions. It determines filament current requirements and plate current drain. It locates "shorts" between grid and plate as well as distortion in the audio system due to tube overloading. It provides for filament circuit and general continuity tests, and also serves as a rapid tube tester.

Any receiver installation, including power supply, can be completely tested in fifteen minutes, and yet this tester is so efficiently designed and compact that it measures only 9″ square x 4″ high, and weighs only 6½ lbs.

Weston
PIONEERS SINCE 1888
INSTRUMENTS

Model 537

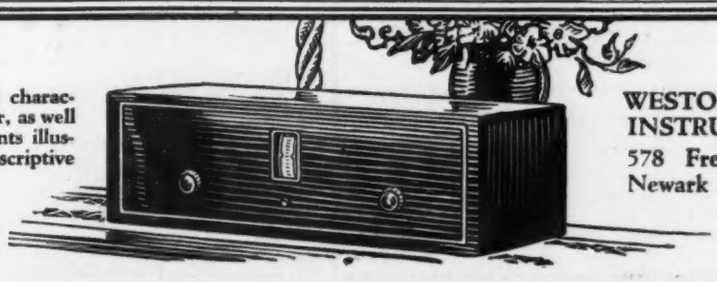
Model 533—Counter Tube Checker

Operates direct from an A. C. light socket or any other A.C.—60 cycle—90 to 130 volt—source of supply. Requires no batteries. Will test every type of tube—A. C. or D. C.—having filament voltages of 1.5, 2.5, 3.3, 5 or 7.5 volts, including rectifying type tubes. Proper voltage regulation is quickly obtained by means of the voltage adjusting dial and the voltage indicator.

Model 528
3-Range A. C. Voltmeter

150/8/4 volts. This compact little instrument is designed for line supply and filament voltage tests of A. C. receivers. A handy kit instrument, exceptionally accurate, light and durable. Contained in mottled red and black bakelite case.

For complete description and test characteristics of the Model 537 Set Tester, as well as the other two Weston instruments illustrated above, write for copies of descriptive circulars just off the press.



WESTON ELECTRICAL INSTRUMENT CORP.
578 Frelinghuysen Ave.
Newark : New Jersey

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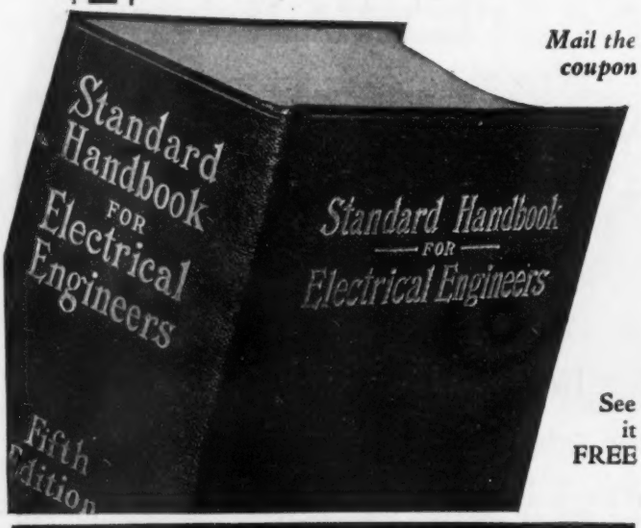

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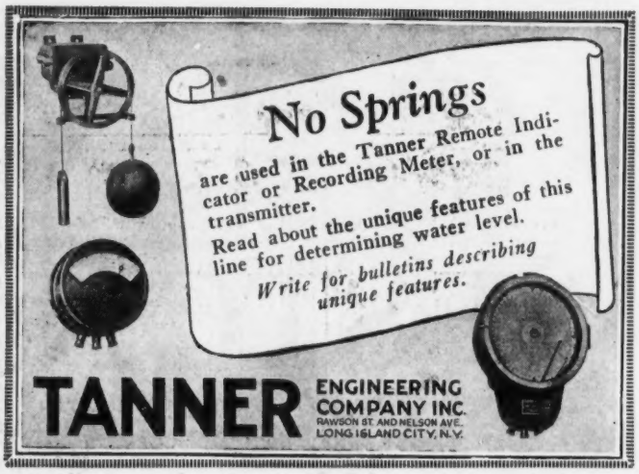
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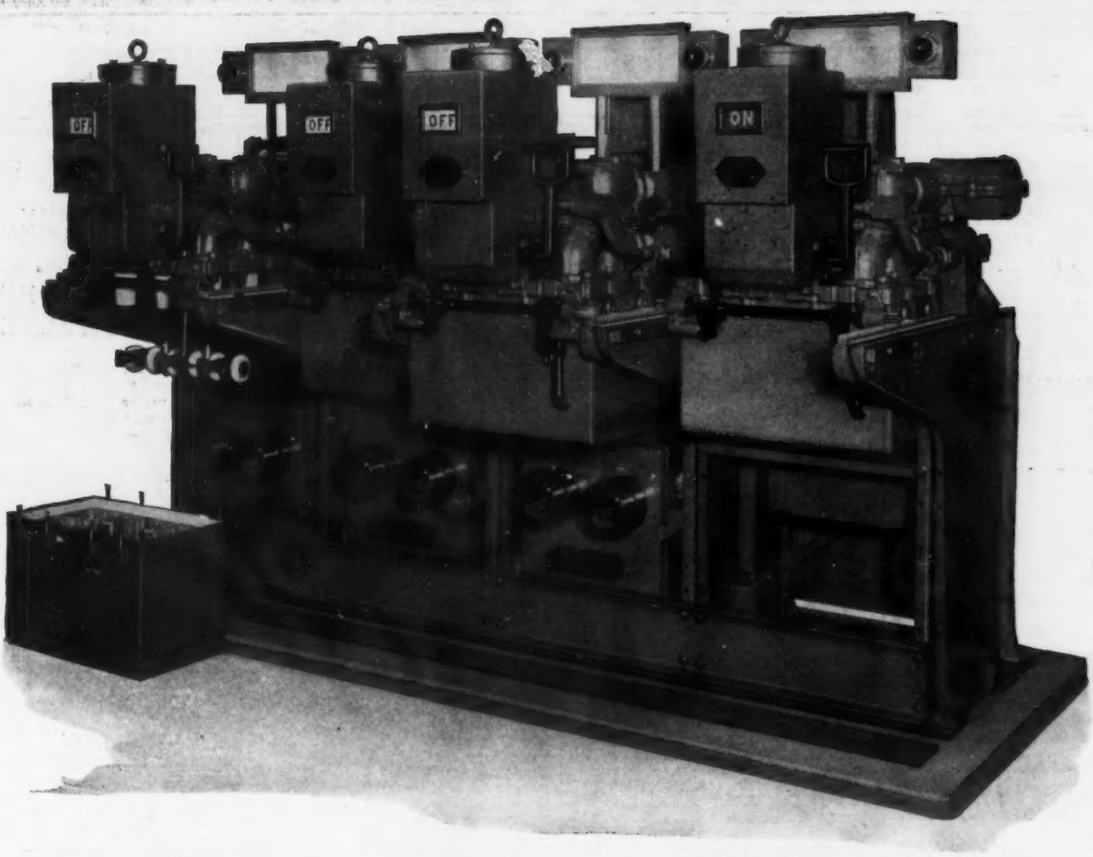

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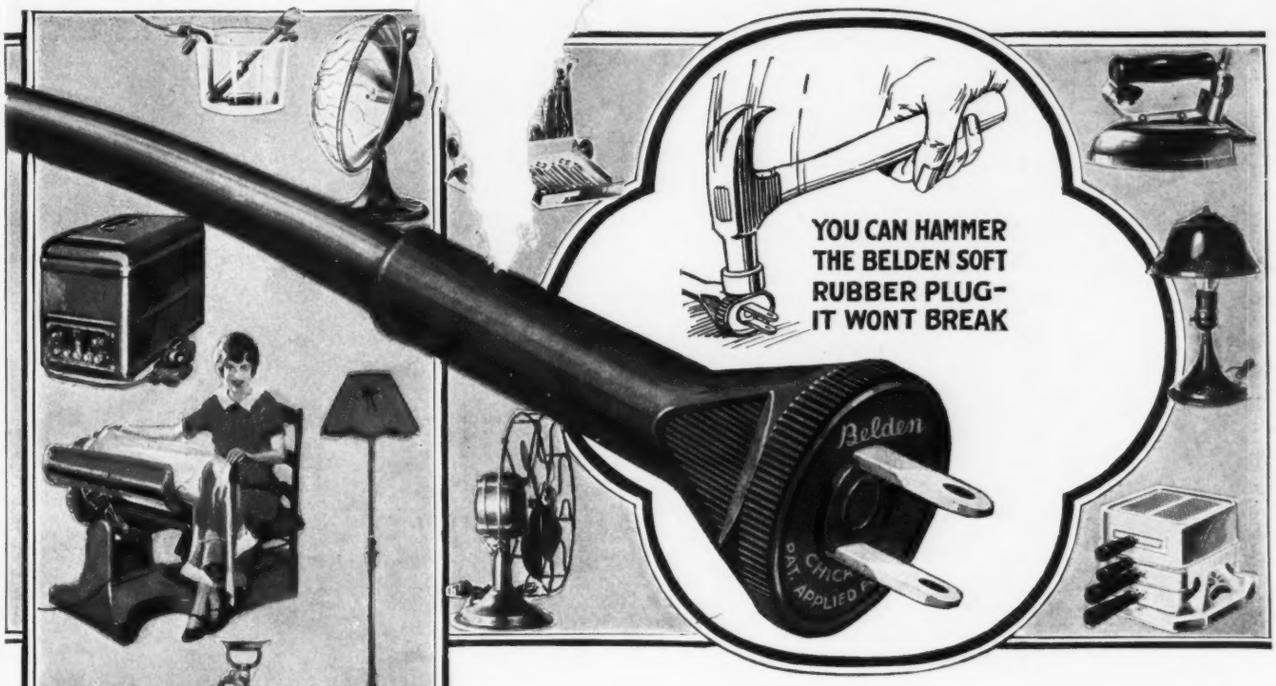

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